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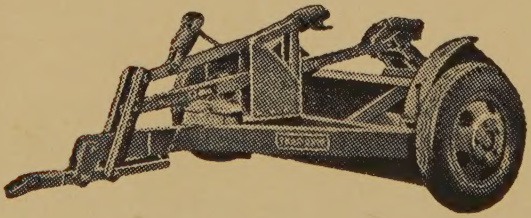

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The JOURNAL of THE DEPARTMENT OF AGRICULTURE

WESTERN AUSTRALIA.

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(Continued on Page 4)

Foreword

By SIR CHARLES LATHAM, M.L.C.,
Minister for Agriculture.

I TAKE over my duties as Minister for Agriculture with mixed feelings—a profound sorrow for the passing of an old friend and colleague in my predecessor, the Hon. Garnet Wood, M.L.C., and a deep sense of pride that I should have been chosen to occupy such an important post.

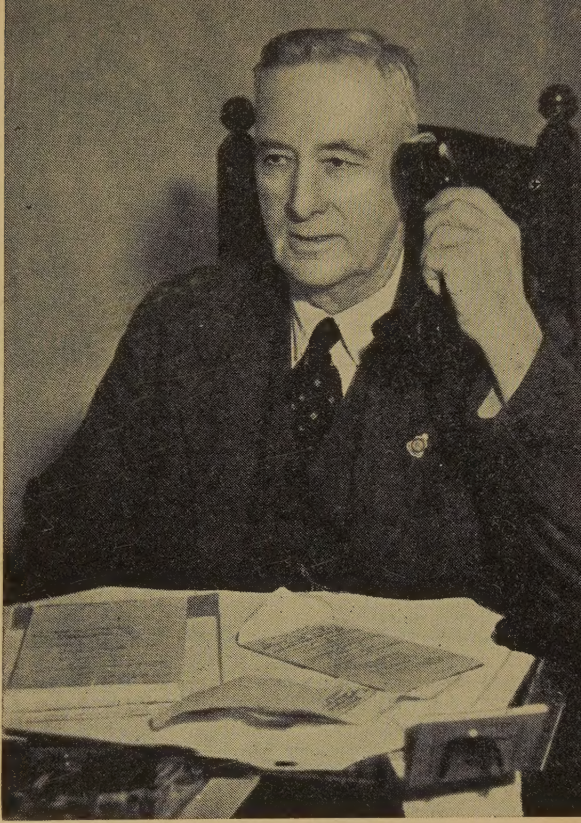
Almost since the beginning of time, agriculture has been the basis of human existence, for the world's peoples must be fed and clothed from the products of the soil. Without the farmer to provide these vital contributions to the wellbeing of humanity we would have known little or nothing of the arts and sciences or of the comforts and amenities which we now regard as the natural concomitants of civilised existence.

Only a little more than two centuries ago, ours was a thinly-populated planet whose people lived close to the soil which satisfied their meagre needs. With the dawn of the Industrial Revolution—the coming of steam-power and a vast expansion of industry—more and more people left the land for the ever-growing industrial centres.

The urban populations increased tremendously and to feed these millions, vast areas of virgin soil were brought into production throughout the world. Spurred by the ever-increasing demand for more food for the workers and more raw materials for the factories, the new lands were recklessly raped of the fertility, which they had accumulated throughout the centuries.

Today the world is realising that its soil reserves are limited—that the account on the Bank of Fertility is grievously overdrawn in many cases—and that the role of the farmer is all-important.

The old days of wasteful land use are gone forever. The modern farmer must work in close co-operation with the agricultural scientist for, in his constant endeavours to increase production, he must take the fullest advantage of every aid which scientific research can make available.


THE MINISTER FOR AGRICULTURE

Farming is the world's most progressive industry and the Department of Agriculture has a vitally important role to play in our community—it has a splendid record of achievement in the past and its future is filled with brilliant promise.

I am proud to have been given an opportunity to take part in these achievements and hope to be able to further the endeavours of my predecessors. During the years that lie ahead, I pledge myself to do my share to making this Department a vital factor in the progress of Western Australia.

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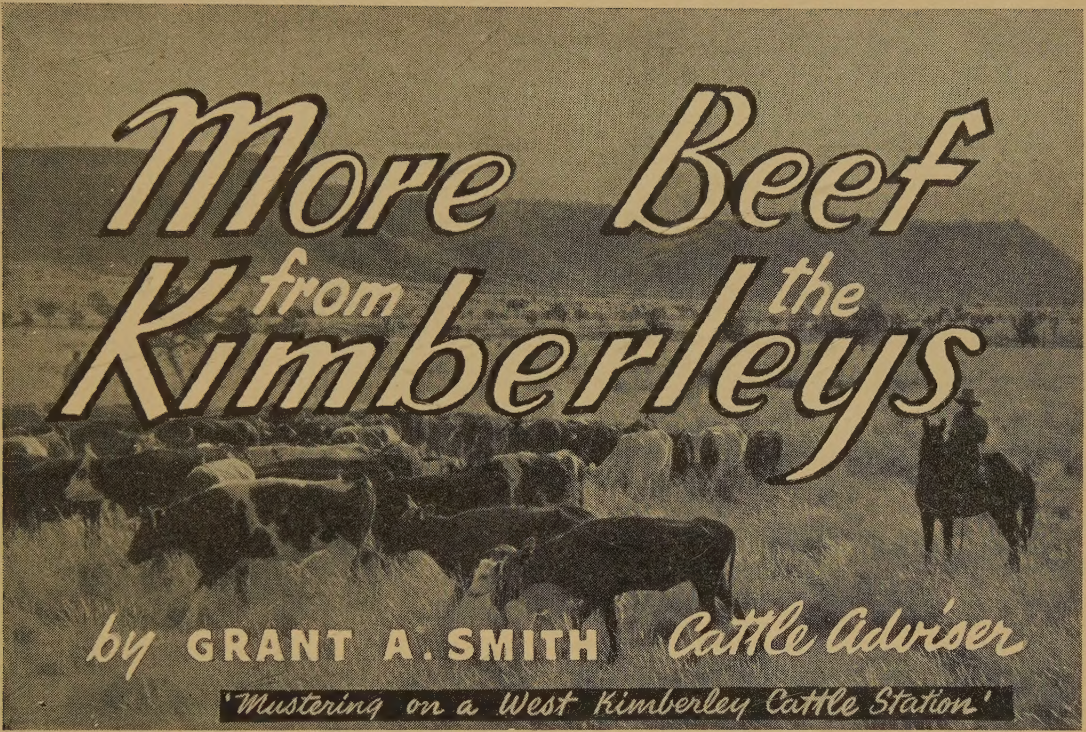
More Beef from the Kimberleys

by GRANT A. SMITH Cattle Adviser



'Mustering on a West Kimberley Cattle Station'

BEEF production in the Kimberleys is an industry which has eked out a precarious existence for many years. Today it is offered an unprecedented opportunity for expansion on sound economic lines, and it is the purpose of this article to offer some suggestions as to how this may best be achieved.

Firstly, let us attempt to review some of the factors which have resulted in beef-hungry countries throughout the world clamouring for substantial additions to their present meagre rations.

Undoubtedly the main group of factors are those originating in Argentina, a country which in pre-war years exported a tremendous tonnage of excellent chilled beef to British and other markets. Political moves in Argentina have whittled down the formerly extensive spheres of British influence in the pastoral, commercial and industrial life of the republic, and Britain no longer occupies a favoured position as a beef buyer.

According to reports there has also been a marked decline in the quantities of beef produced in Argentina, due to unwise land use and a serious lack of rural labour. Increasing industrial activity in the cities has drawn people from the land, and the higher wages offered in the factories have resulted in higher home consumption of beef with a corresponding reduction in exports. Added to these has been the disinclination of the Argentinian Government to make beef available at satisfactory prices.

As beef is not a product which lends itself to heavy short-term increases in production it certainly appears that the existing shortage will not be overcome within the next few years.

g. 1.—At Glenroy Station, Air Beef Pty. Ltd. is operating an inland abattoir d transporting the carcasses by Bristol Freighter aircraft to the Wyndham eatworks. Photo shows cattle in the holding yards with the aircraft and loading gantry in the background.

—Photo by courtesy of West Australian Newspapers Ltd.

KIMBERLEY CONDITIONS

Before listing the fundamental requirements of a sound and economic production programme for the Kimberleys, it might be well to review the present conditions of the industry in these areas.

Although there are fairly wide variations on different stations and in different districts, the following conditions apply generally throughout the Kimberleys.

From about January to March pastures commence to grow vigorously in response to the monsoonal rains, with the result that from about April to June there is ample green grass and plentiful surface water. During this period stock improve rapidly and all classes of cattle are usually in good condition.

From July onward the feed dries out rapidly and towards the end of September stock are rapidly losing flesh and beginning to weaken. Serious drought conditions usually exist from October to December and even dry stock are only in backward store condition. Weaners and cows with calves become very thin and weak.

There is very little fencing in the Kimberleys and on the majority of the properties bulls, cows, calves, weaners and in some cases bullocks are all running together. Where bullock paddocks are provided, their main purpose is to facilitate mustering for sale.

NO CONTROLLED MATING

Little or no supervision of breeding is possible so that good quality bulls are able to mate with nondescript females of any age, and conversely, rough scrub bulls from the home or adjoining leases can mate with the best quality cows. Owing to this lack of supervision the bulls are not well distributed throughout the properties and there may be too many in one section and not enough in others. During the drought period of the year, and in many cases earlier, most cows suffer from a form of temporary sterility and do not come into season, so that the bulls tend to drift away from the herds.

Owing to the low nutritional standards, a number of the cows do not mate every year and in the barren intervals they may remain in fairly good condition. Other cows in very low condition may often be found nursing both a young calf and the previous year's weaner. With no supervision over mating, many two-year-old cows give birth to calves sired by big-framed bulls and a great many of them die when calving. Others that survive the ordeal remain stunted in growth and constitutionally weak for life. Cows which are suckling calves may become badly affected with "creeps" or "pegleg" which is one of the main symptoms of phosphorus deficiency.

With the advent of the green feed, a large number of the cows come into season and the bulls, also freshened by young nutritious pastures, again return to work. This breeding cycle results in a large percentage of the calves being dropped well after the flush period of the year so that they are born during the dry season when the cow is endeavouring to exist on pasture, the low nutritional value of which is insufficient to serve even as a maintenance ration.

As cows living under these conditions are unable to produce sufficient milk to maintain the calves, a great many young cattle die although they may exist long enough to have been included in the year's branding tally, and to have dragged their mothers down to a state of poverty from which there is no recovery.

UNPROFITABLE STOCK

All cattle are bred and, with few exceptions, live their whole lives on the one lease until the bullocks are old enough and strong enough to walk to a meatworks or a ship. Due to the fact that no store market is available to Kimberley cattlemen, any bullocks not sufficiently well fleshed to show a net return after all expenses associated with their sale are deducted, must be held on the lease and given a chance to increase in weight.

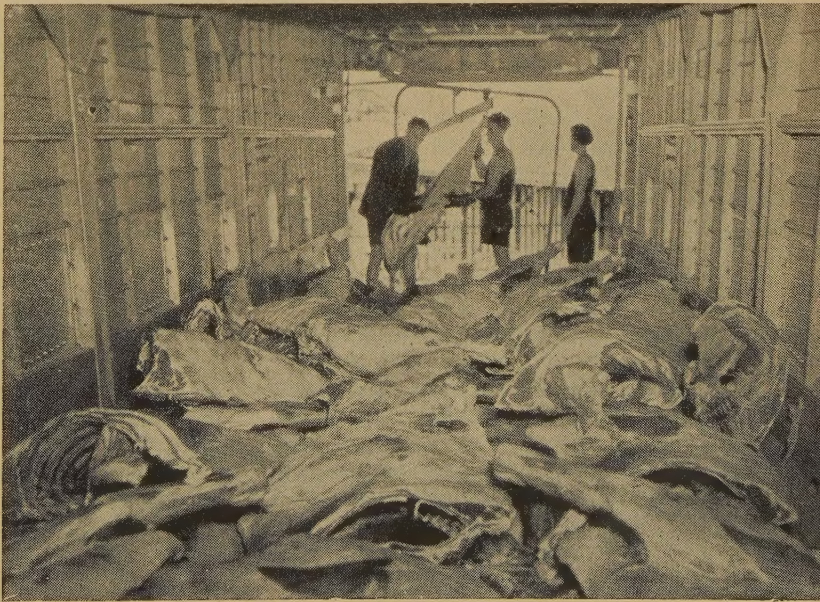
This results in the holding on the station of many aged store bullocks for which there is no sale. These cattle far from being an asset, are a distinct liability. Every day that they are retained on the run, they are consuming grass and water which could be better utilised in maintaining a cow with a calf or in increasing the weight of younger and better quality steers.

Most Kimberley cattlemen are branding 20 per cent. to 25 per cent. of their herd numbers, keeping their annual crops of heifers as breeders to maintain their branding numbers and they are consequently only able to sell about 10 per cent. of their herds annually.

These figures suggest that twice the number of cattle die or are wasted every year as are sold, and in view of the fact that Australia is freer from stock diseases than any other cattle-raising country in the world they suggest that all is not well with our beef industry. Australian sheepmen are recognized as the world's best, and I am convinced that by an overhaul of our beef production methods it should be possible to lift the cattle industry to the social and financial status of the sheep industry.

It is my opinion that the two main factors responsible for the terrific wastage in cattle and beef in Northern Aus-

Fig. 2.—Stowing quarters of beef in the Bristol Freighter at Glenroy Station.
—Photo by courtesy of West Australian Newspapers Ltd.



g. 3.—An aboriginal stockman at Glenroy Station.
-Photo by courtesy of West Australian Newspapers Ltd.

tralia are the mineral deficiencies in the diet of the cattle, and the current methods of open-range uncontrolled breeding.

THE NEED FOR MINERALS

Back in the days of white moleskin pants and red shirts, cattle-raising was mainly a rule-of-thumb business. Land was cheap and plentiful and a herd located on country which provided grass and water for most of the year could generally be depended upon to produce sufficient saleable stock each year to cover expenses and show a profit. Since then, many areas have been overstocked with consequent reduction in both the quality and the quantity of the feed. In countries where the aim is to produce store cattle to pass along to the fatteners this rule-of-thumb system may still provide reasonably good returns. Unfortunately, there is no store market for Kimberley cattle, and the climatic conditions and the nature of the terrain are such that tons of good beef is walked off the cattle before they can be slaughtered at the coastal meatworks or shipped alive to the southern markets.

The manner in which the industry is conducted at present does not lend itself to the production of accurate statistics so it is difficult to support my contentions by any actual figures but I am convinced that many of the handicaps imposed by lack of protein in the fodder could be offset to a large extent if we were able to remedy another important deficiency—that of minerals.

Over most of the world's cattle-raising areas, a new conception of livestock husbandry has come into being as a result of scientific studies of animal nutrition. The importance of minerals in the diet, for instance, has but recently received full recognition and modern cattlemen no longer believe that a bellyfull of grass and adequate water is all a herd needs to breed healthy calves and produce payable quantities of beef.

Certain minerals are as necessary for the adequate nutrition of cattle as is the grass itself and, even where feed is abundant, if it does not supply these minerals the cattle will suffer from malnutrition and disease just as certainly as, though perhaps more slowly than, if there was an actual shortage of feed.

Throughout the best feed months in the year in the Kimberleys when the stock are grazing on young green grass, all cattle do well and improve rapidly in strength and fleshing. During this period there is little evidence that the cattle are affected by any nutritional deficiencies, but that does NOT apply after the grass has dried out.

PHOSPHORUS IS ESSENTIAL

There appears to be little evidence as yet that Kimberley cattle are seriously deficient in any minerals other than phosphorus but this mineral is essential to successful cattle and beef production. In combination with its partner, calcium (lime), phosphorus is primarily required to build up the skeleton of the animal.

Where there is a serious deficiency, or an imbalance of phosphorus and lime in the feed, healthy bone cannot be formed and the growth, weight, fertility and milk production of the animals are adversely affected. These symptoms are noted in most cases of phosphorus deficiency and accompanying them is depraved appetite, the most common evidence of which is a craving for bones and the chewing of carrion and all kinds of rubbish.

This depraved appetite may lead to excessive salt consumption where salt is available to the cattle, and where stock eat carrion such as decaying carcasses they are liable to die from a secondary disease known as botulism or "toxic paralysis".

Fig. 4.—A droving plant returning from Wyndham along the Ord River, East Kimberley.
—Photo, W. M. Nunn.

Continued phosphorus deficiency among cows nursing calves results in the disease commonly known as "creeps" or "pegleg" which is characterised by bone changes, lameness and stiffness of the joints when walking. "Creeps" is usually the final stage of the deficiency disease and many cows in this condition will die unless their calves are weaned to prevent the heavy drain on the system, or unless they are supplied with adequate amounts of phosphorus to meet their requirements.

It has been estimated that about 85 per cent. of the phosphorus in an animal's body is contained in the skeleton. Most of the remaining 15 per cent. is in the body tissues with some always in the blood to meet the phosphorus requirements of all parts of the body. Approximately one-tenth of the weight of an animal's skeleton consists of phosphorus, therefore a cow weighing 1,000 lb. with a skeleton weighing about 150 lb. should contain in her bones about 15 lb. of phosphorus. Her tissues and blood should contain approximately another 2 lb. so that there should be about 17 lb. of phosphorus in her body. As the cow grows and builds more bone, puts on flesh or makes milk to rear a calf she requires additional phosphorus if she is to remain in good health.

Extensive research into cattle-raising on phosphorus-deficient pastures has been carried out in overseas countries for many years. In this country also, the stage of growth of the pastures has been found to be an influential factor in determining its phosphorus content. Fresh new pasture growth contains much more phosphorus than at any other stage of development. When pasture has matured and dried its phosphorus content is very low.

(In the second portion of this article which will appear in the May-June issue, the author discusses the possibilities of providing a phosphatic supplement for station cattle and makes some suggestions for improving herd management.)

GOLDSBROUGH MORT

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SHEEP CRUTCHING TECHNIQUE

By W. L. McGARRY, Sheep and Wool Adviser
and
M. BUTLER, Shearing Instructor

TO obtain the best results and achieve the maximum returns from wool-growing, it is essential that the sheep should be efficiently cared for. Correct crutching, systematically performed as often as is necessary is a definite step towards ensuring the comfort and welfare of the sheep. A large proportion of the sheep in the agricultural areas are crutched either too early or too late, and many flocks are not crutched at all. This state of affairs is mainly due to the shortage of professional crutchers so that there are obvious advantages in farmers and their sons being able to crutch their flocks themselves at the right times of the year.

The practical demonstrational and instructional work in crutching combined with mulesing, which has been carried out in the farming areas, is now supplemented by this article. Those who have attended these demonstrations will find the article very useful for reference, and to others it will be of practical assistance during their crutching operations.

TWO CRUTCHINGS YEARLY

With the usual autumn lambing, and where shearing is carried out during late winter and spring in the farming areas, it is recommended that at least **two full crutchings** be carried out each year among flocks of Merino ewes. The first crutching should be done about four weeks before the ewes commence to lamb, and the second about four weeks before shearing, or earlier if considered necessary. In the odd years when substantial summer rains occur it is advisable to complete the first crutching earlier.

Definite advantages follow as the result of the second crutching. These are:—

(1) A large saving in wool is effected owing to the small percentage of stain and dag at shearing time. A definite saving of shed labour and time follows upon the absence of stained and daggy wool in the wool room.

(2) The stained wool from the crutch area does not soil other wool with which it comes in contact, and soiling of fleeces due to rubbing by the sheep in the pens is avoided.

(3) While shearing is on, there is far less risk of sheep becoming fly-struck while waiting to be shorn.

(4) The sheep come on to the board clean, which usually results in better all-round shearing than when the sheep are presented in a dirty condition.

FAULTY CRUTCHING

Crutching in the farming areas at present is usually carried out with speed as the main consideration, and as a result, undercrutching, overcrutching, and faulty crutching are almost general practice. Little consideration is given to the performance of efficient work which, when effected, confers the maximum protection from crutch and tail strike with the removal of the minimum quantity of wool. In addition, some styles, less effective than others, are hard on both operator and sheep. This latter applies particularly to ewes that are heavy in lamb when rough treatment such as "doubling-up" of the sheep, kneeling on them, or pulling up the back legs is likely to cause injury and subsequent loss.

GENERAL DESCRIPTION OF STYLE

The style recommended for crutching closely follows that which has been recommended for shearing those particular portions of the sheep, and as such it will be good practice for learner-shearers, assisting them to become familar with the machine and the holding of the sheep for subsequent shearing.

With the sheep in a sitting position, the starting blow is made around in the crutch immediately below the teats—care being taken to cover the teats with the fingers as a safeguard against damage. Next, make an outward blow on the top inside of the right hind leg. At the completion of this blow turn the machine and shear back inside the leg and lower crutch—continuing on outside the lower inside of the left hind leg. One more blow on the top inside of the left hind leg will complete the crutch with the use in all of only four blows up this stage. When crutching ewes in lamb or ewes with lambs, the wool should, at this stage, be removed from the bottom of the belly just above the teats. Losses can occur through the inability of the lamb to find teats that are partly covered or obscured by belly wool.

Next, moving the sheep's right foreleg to a position between the legs of the crutcher, move yourself back slightly and exerting slight pressure with the left hand in the sheep's flank to straighten the leg, shear back along the lower outside portion of the left hind leg and over the tail. Care should be taken to run the machine with the bottom tooth on the skin and the top tooth raised to produce a bevelling effect on the outer edge. Wigging, or shearing the wool from around the eyes of any sheep that are wool-blind, can best be done at this stage.

Next bring the sheep into the position as for finishing shearing and, using the left hand in the flank, the crutching can be completed, again taking care to bevel the outer edge.

The illustrations accompanying this article show the holding and the correct and effective methods of crutching, wigging, and ringing in detail.

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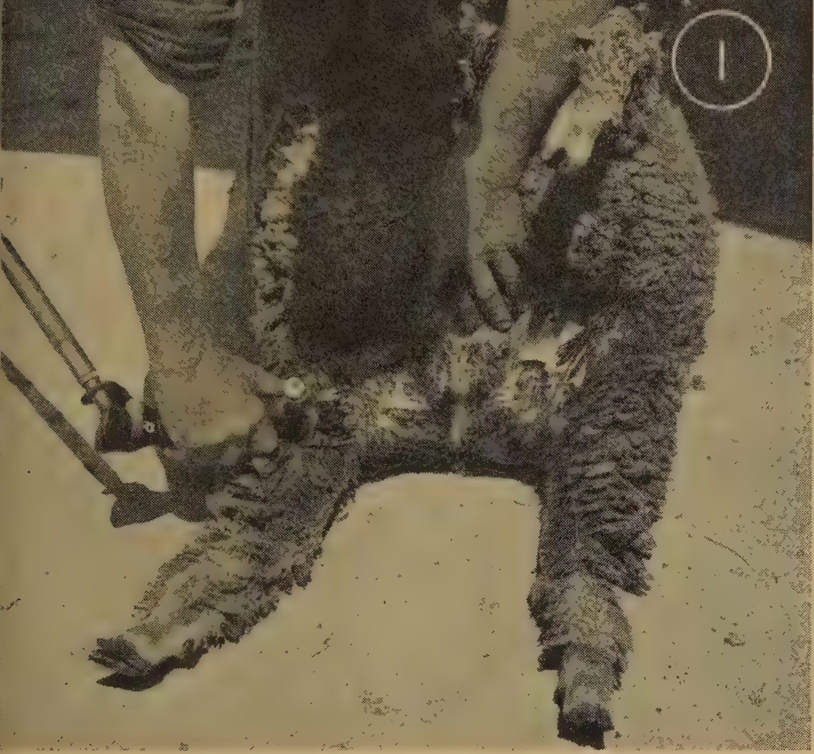
Arrangements have been made for the compilation of a comprehensive index to be incorporated in the December issue—a feature which will greatly enhance the value of the Journal as a work of reference.



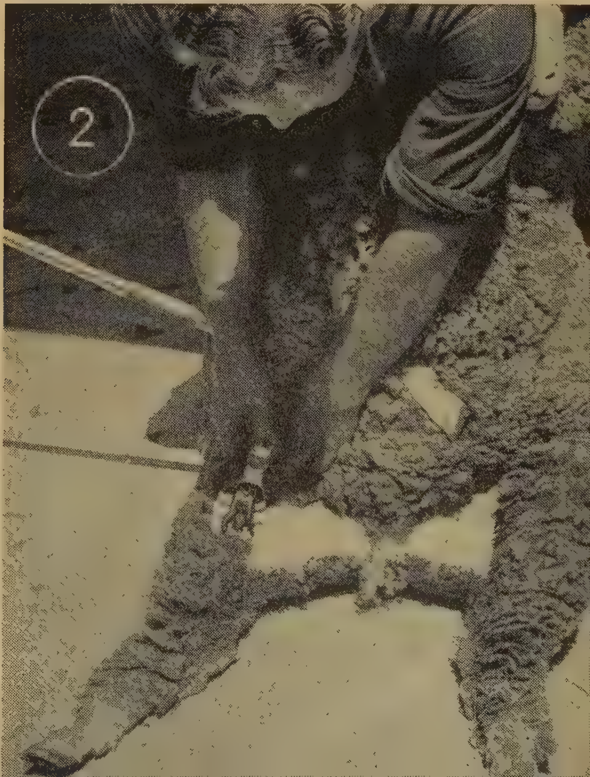
Detailed Description of Style

Fig. 1.—FIRST BLOW IN CRUTCH.

With the sheep in a **comfortable** sitting position and the fingers placed over the teats to obviate the danger of damaging them, make the first blow immediately below the teats. Shear **around** inside the crutch and not in a **downward** manner when in this position.

Fig. 2. — SECOND BLOW ON TOP INSIDE OF RIGHT LEG.

Now move the left hand into a position in the right flank to prevent the sheep lifting the leg and shear outward on the top inside of the sheep's right hind leg. With this blow completed, turn the machine into position for the start of the third blow.



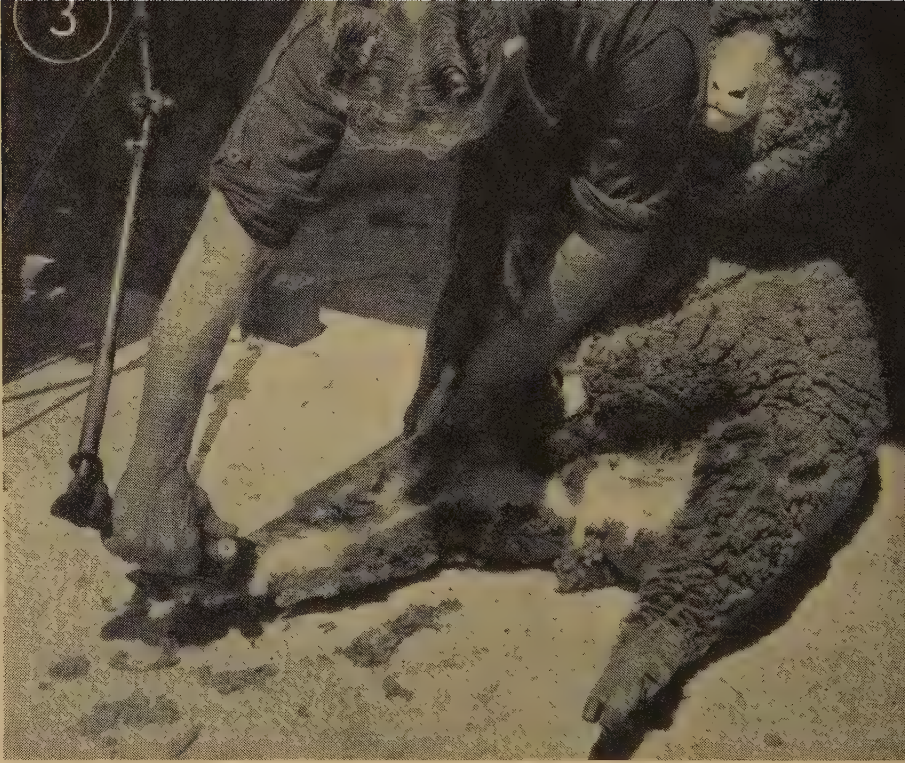


Fig. 3—START OF THIRD BLOW.

Still holding the sheep in a sitting position, alter your own position by moving the right foot slightly forward in order to give better reach. Now press the left hand into the flank and shear back along the lower portion of the leg and around inside the crutch.

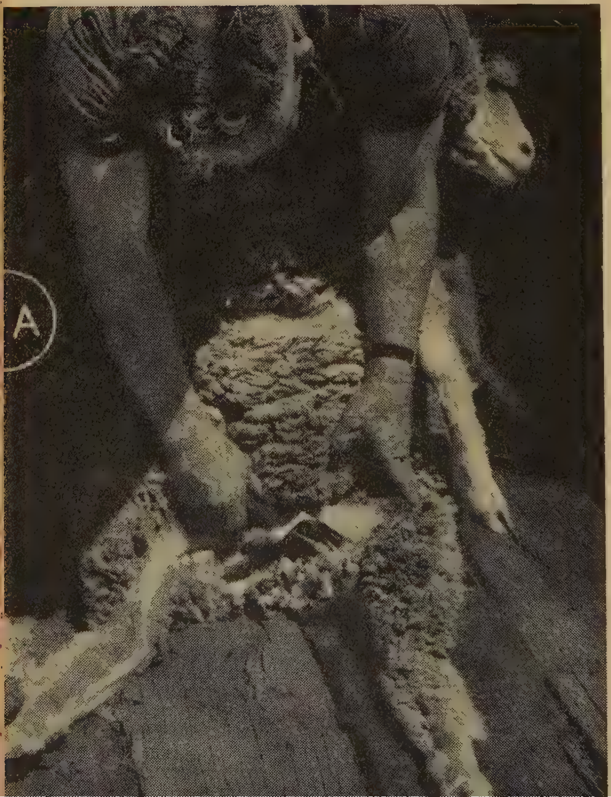


Fig. 3a. — CONTINUATION OF THIRD BLOW.

This illustration shows how the left hand has been moved to enable the blow to be continued on outward on lower inside of left hind leg.

An additional blow outward on the top inside of the leg completely cleans the crutch.

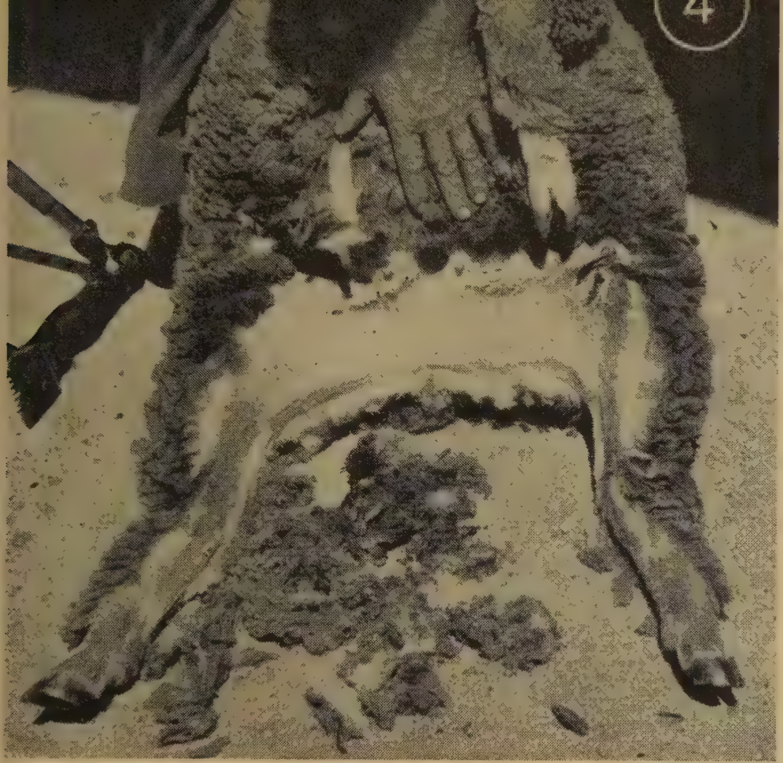
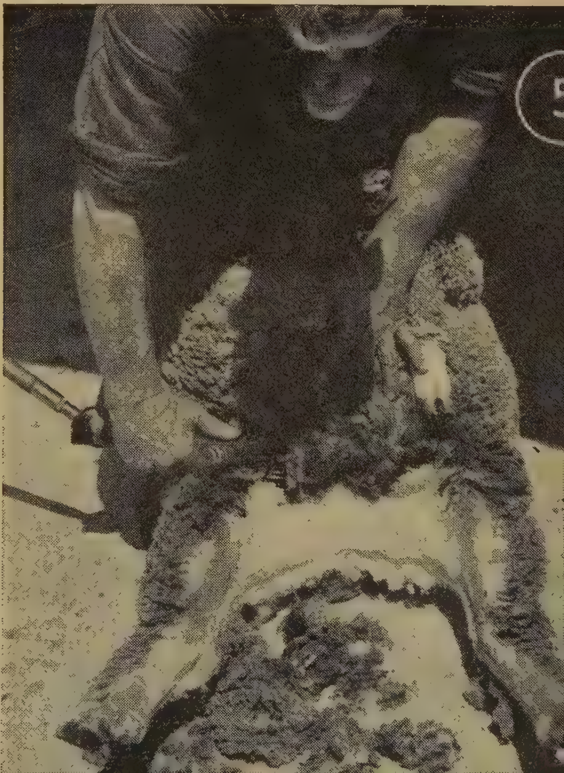


Fig. 4.—INSIDE OF CRUTCH CLEANED.

This illustrates the crutch completely cleared of wool—using only **four** blows with the machine—and the wool removed from the insides of the legs. By shearing **around** in the crutch the danger of cutting sheep is considerably lessened and the work can be accomplished with greater ease. At this stage the wool should be removed above the teats of in-lamb ewes.

Fig. 5.—SHEARING ABOVE THE TEATS.

Still holding the sheep in a sitting position with the left hand on the belly, shear one blow above the teats. At the same time leave the wool bevelled by holding the machine at the correct angle, not flat, and then remove the remaining wool so that the teats are exposed. Care will be needed to avoid damaging the teats when removing the wool in this area.



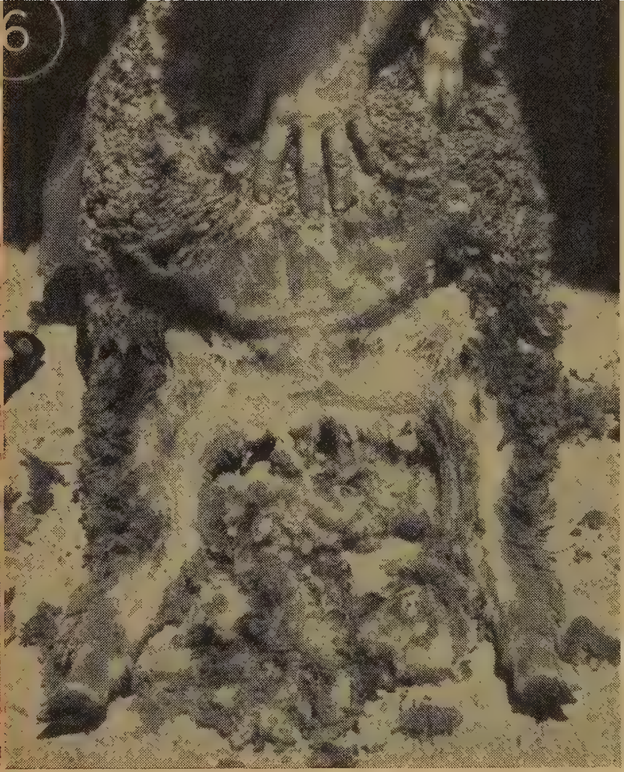
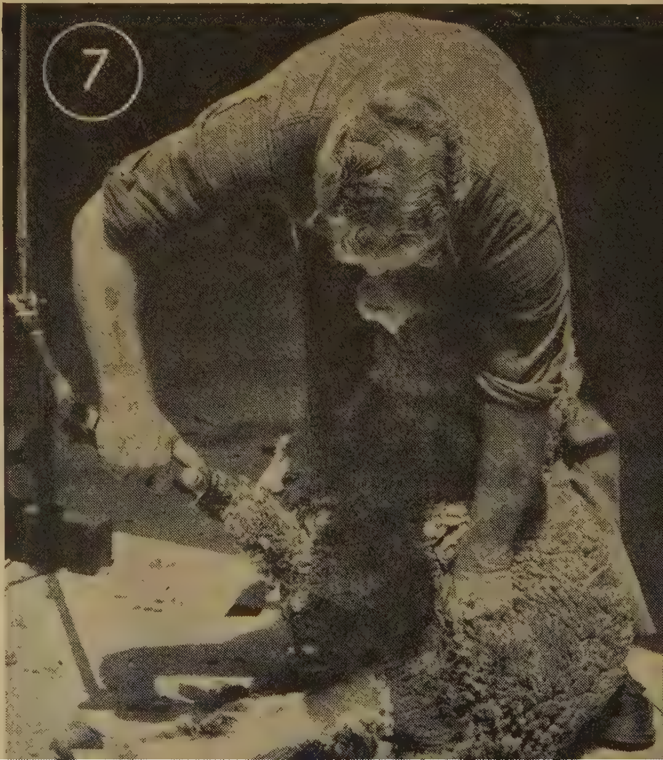


Fig. 6.—TEATS CLEARED OF WOOL.

This illustrates the teats completely exposed and easily accessible to the lamb. With the teats exposed the risk of losing lambs is reduced because losses can occur through the inability of lambs to find teats that are partially or wholly covered with wool. In addition, the risk of damaging the teats during subsequent shearing is minimised as they are more readily seen.

Fig. 7.—SHEARING THE FIRST HIND LEG.

It will be necessary at this stage to alter the position of crutcher and sheep slightly to enable the lower part of the left hind leg to be shorn. This can be brought about by placing the sheep's right foreleg between the legs of the crutcher, who then moves slightly back and around to the right of the sheep, just sufficient to allow it to lean back so that its head rests in his lap. When pressure is applied with the left hand in the flank the sheep's leg can be held straight and the wool shorn from the lower part, whilst in this position. In making this blow it is necessary to shear back along the leg, at the desired width, to the tail and then remove remaining wool from the lower portion of the leg. Always hold the bottom tooth of the comb on the skin and the top tooth raised in order to achieve a bevelled effect on the upper edge of the wool.



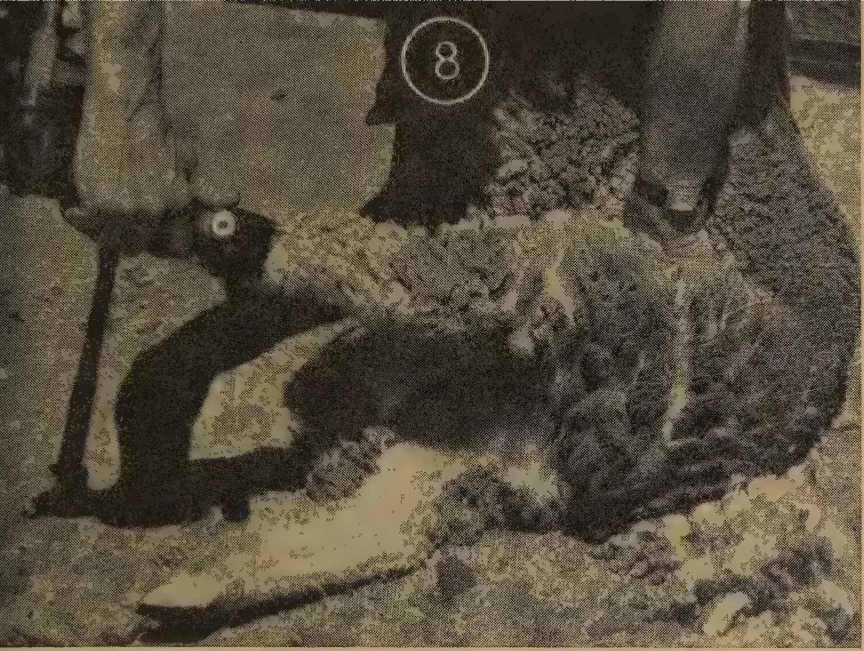


Fig. 8.—START OF BLOW ON FIRST HIND LEG.

This more clearly illustrates were pressure is applied in the flank to straighten the leg and the manner in which this blow is made. Care should be taken to leave the wool bevelled and a little practice will enable this to be carried out quite effectively.

Fig. 9.—WOOL BEVELLED AND FIRST HIND LEG COMPLETED.

This illustrates the bevelled edge with the completion of the first hind leg. A bevelled edge to the wool is most important in order to eliminate the cover or shelter provided by a straight edge, which tends to fall over as the wool grows. Re-soiling will also occur more quickly when the wool is left with a straight edge and falls over as it grows longer. Note that the area over the tail has not yet been shorn.

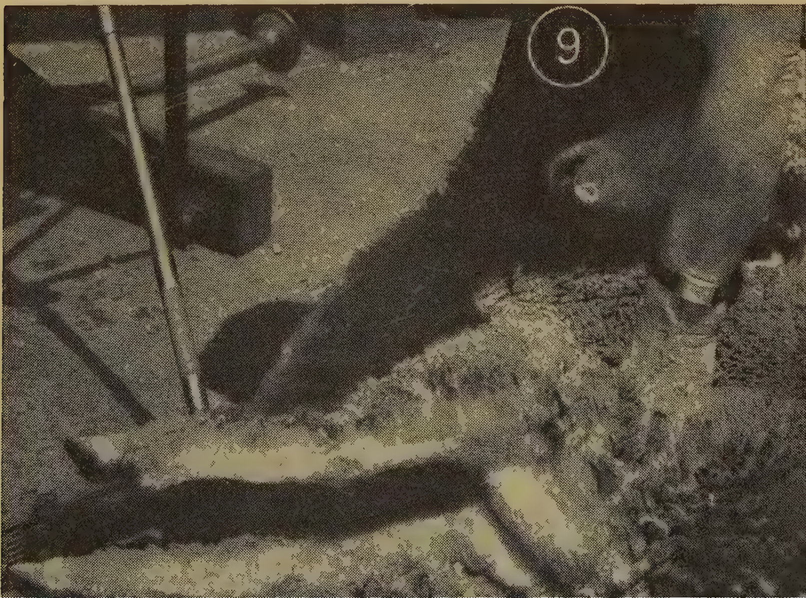


Fig. 10.—SHEARING OVER THE TAIL.

After finishing the leg, place the left hand on the sheep's rump and, moving slightly backward, shear over the tail. This will allow the last hind leg to be shorn with greater ease. Note how the wool has been bevelled. At this stage the sheep will be in the best position for wigging, which should be done before the sheep is turned in the opposite direction to complete the crutching.

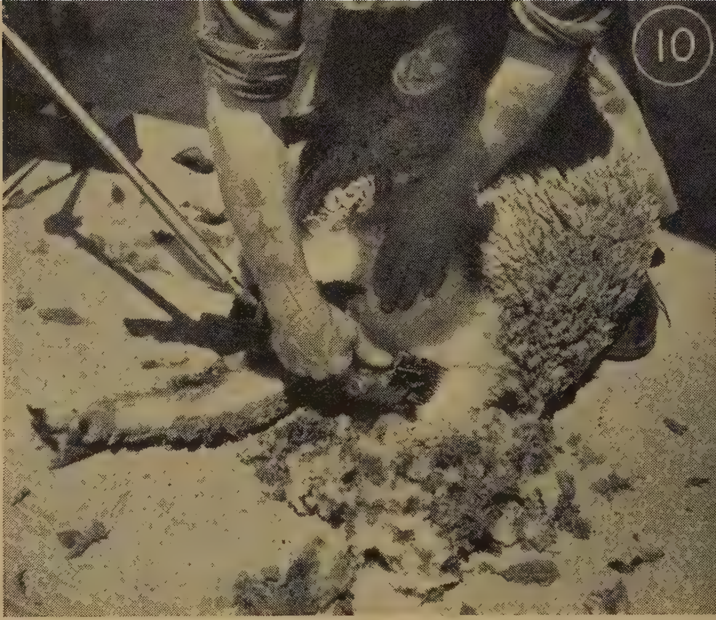
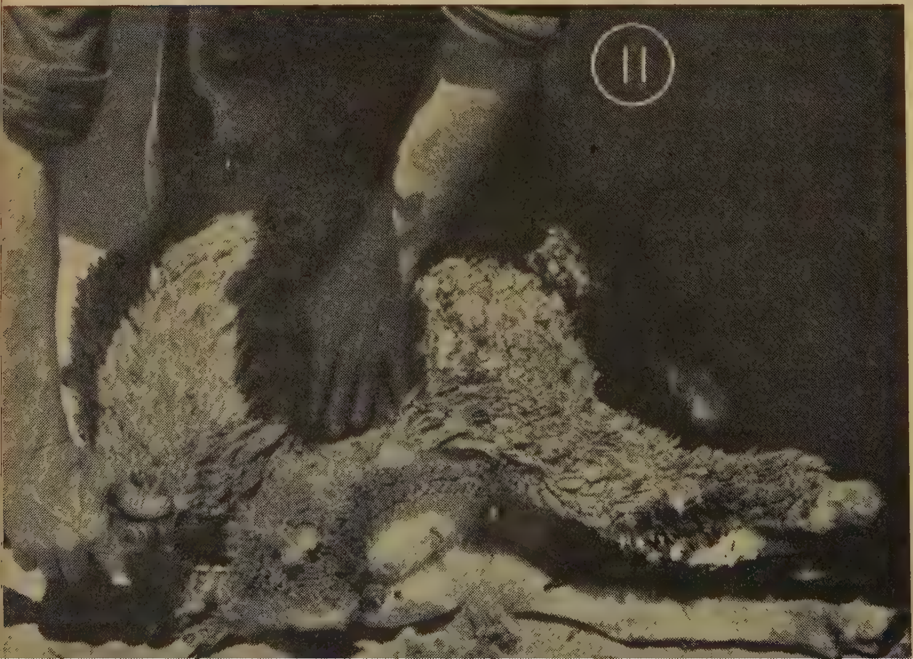


Fig. 11.—STARTING THE LAST HIND LEG.

Before starting to shear the wool from the last hind leg it will be necessary to tu the sheep to face in the opposite direction with the legs of the sheep lengthwise along t board. To do this take hold of the sheep's right foreleg with the left hand, ar removing the foreleg from between the crutcher's legs the sheep can be turned eas and quietly to a position facing in the opposite direction and laying back against t legs of the crutcher. With the sheep in this position place the left hand on the fla and shear a blow outward from the tail along the leg, bevelling the wool on the upp edge in the same manner as on the previous leg.



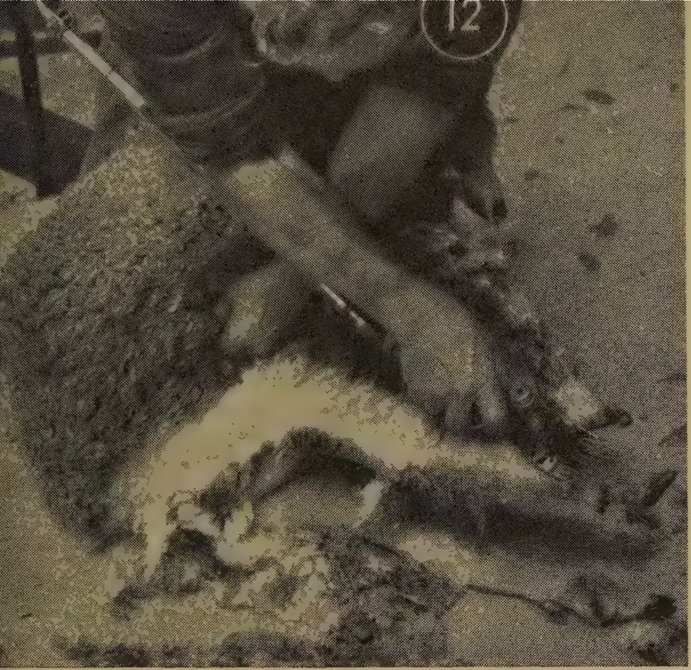
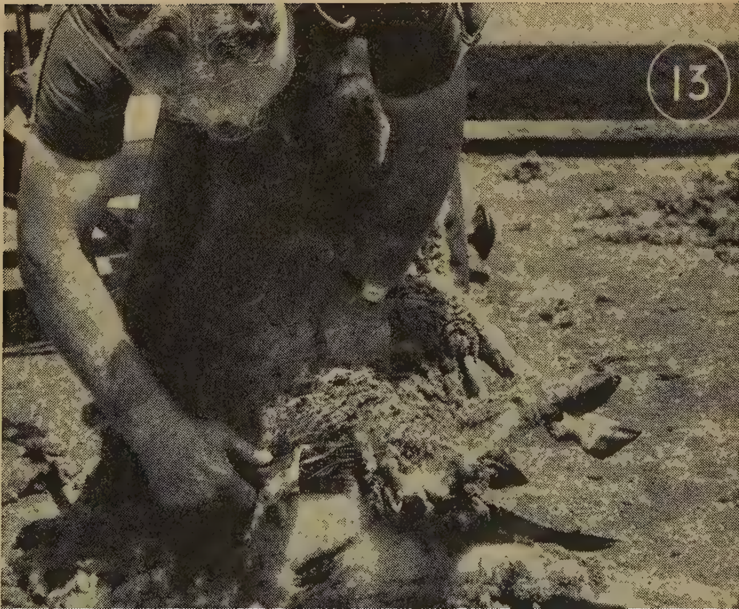


Fig. 12.—FIRST BLOW COMPLETED ON LAST LEG.

This illustrates the completion of the first blow on the last leg. It is now necessary to shear off the remaining wool from the lower portion of the leg, using just sufficient pressure with the left hand to keep the sheep's leg straight in order to eliminate the danger of cutting the hamstring.

Fig. 13.—SHEARING LAST HIND LEG. (WRONG)

This illustrates how hamstringing can occur as a result of the sheep being out of position and not under full control.



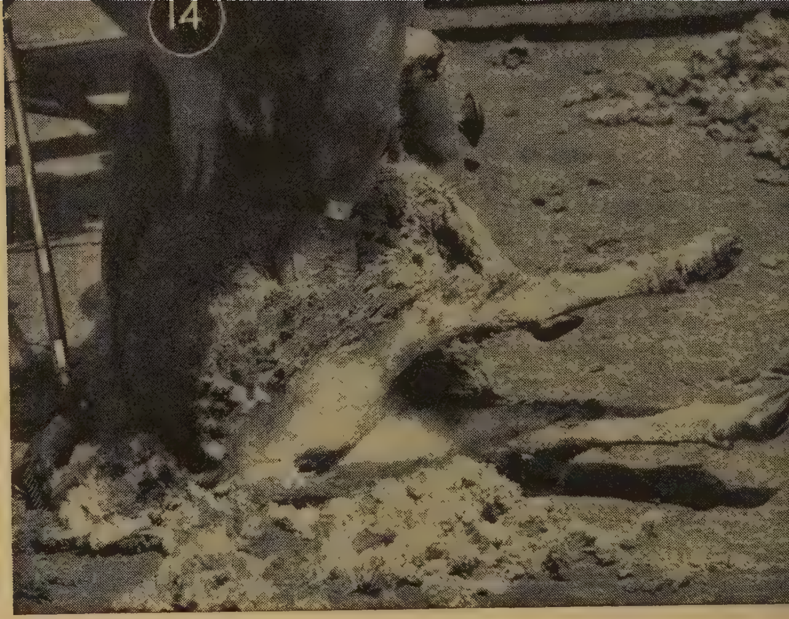


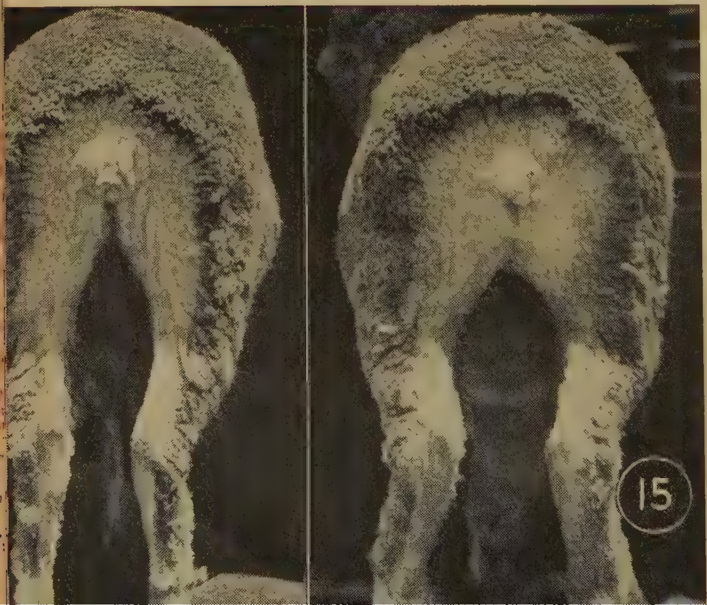
Fig. 14.—COMPLETION OF LAST HIND LEG.

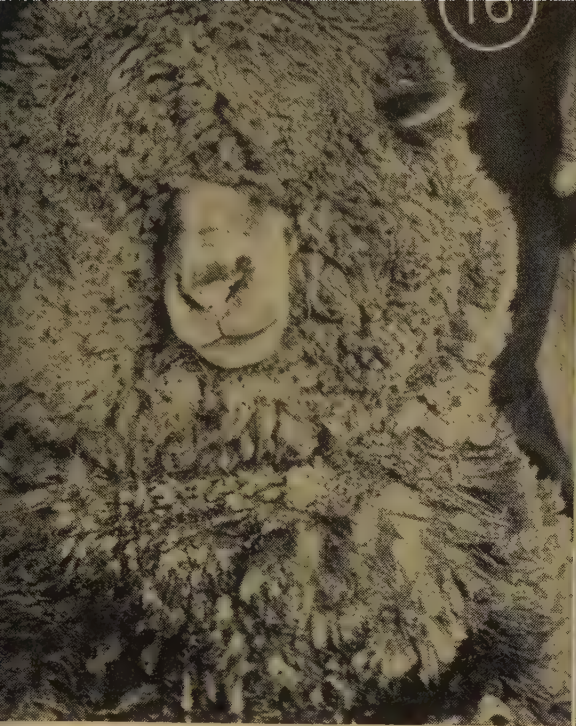
The last hind leg has now been completed and the sheep correctly and efficiently crutched.

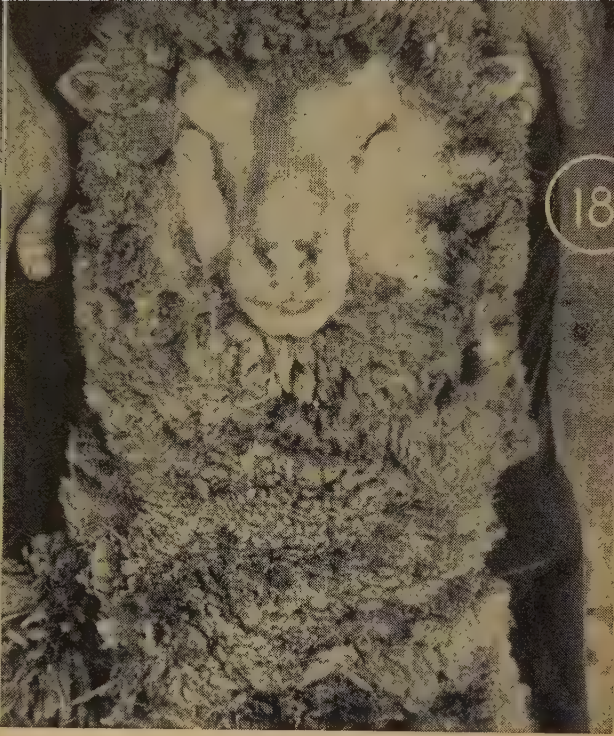
Fig. 15.—THE FULLY CRUTCHED SHEEP.

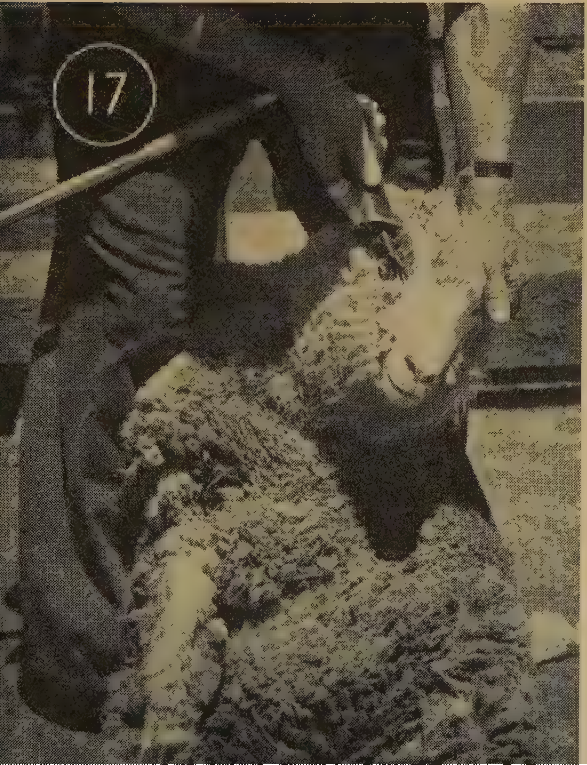
Note how the wool is shorn from the hocks and lower legs with sufficient width at the buttocks and with the correct distance above the tail. Note also how the wool has been bevelled to eliminate a straight edge, which, as the wool grows, tends to fall over and create pockets and cover which attract the flies and provide protection for maggots.

Compare this photo with Figs. 30-32.









Wigging

Fig. 16.—A WOOLBLIND SHEEP.

Such sheep should be "wigged." The wool should be removed from around the eyes in order to give the sheep a chance to thrive. This should be done after shearing over the tail and before turning the sheep to complete the crutching. (See Fig. 10.)

Compare this photo with Fig. 18.

Fig. 17.—WIGGING.

Straighten up from position shown in Fig. 10 and shear the wool from around the eyes by making a blow over the left eye back toward the ear, and a second blow outwards over the right eye toward the face.

Fig. 18.—A WIGGED SHEEP.

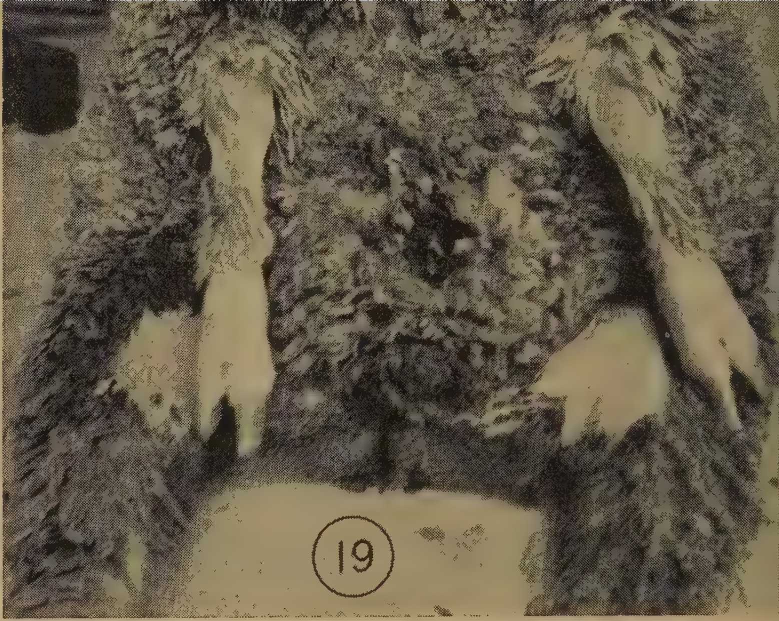
The wool has now been removed from both eyes, allowing freedom of vision.

Compare with Fig. 16.

Ringing

Fig. 19.—STAINED PIZZLE.

When crutching wethers or rams ringing is also often required. This is best done with the sheep in a sitting position and before starting the crutch. All stained wool surrounding the pizzle should be removed to allow free drainage and make the area unattractive to flies. Ringing also assists in reducing the incidence of sheath rot.



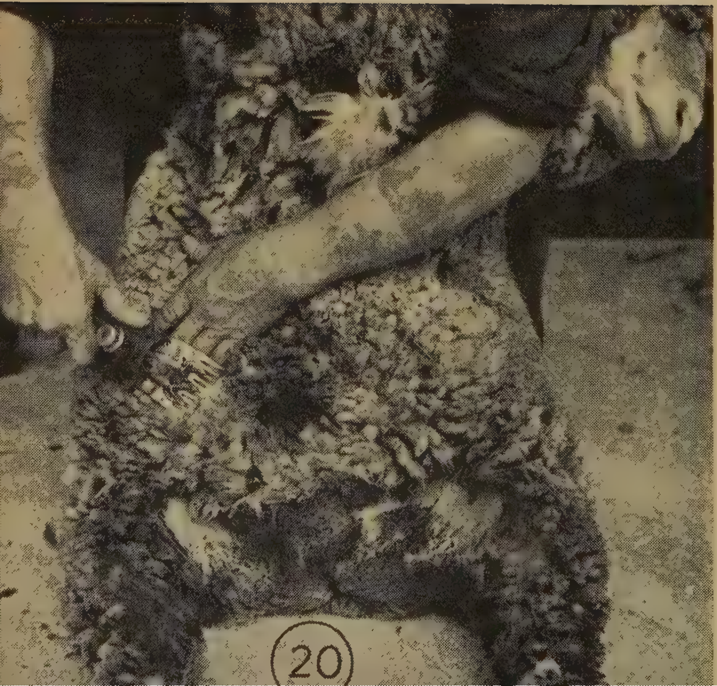


Fig. 20.—COMMENCEMENT OF RINGING.

Place the left hand firmly on the belly and start by making a short **crosswise** blow above the pizzle. **Do not shear downward.** Cross blows lessen the chances of cutting or destroying the organ. Next remove any remaining stained wool until the pizzle is free of wool and completely exposed.

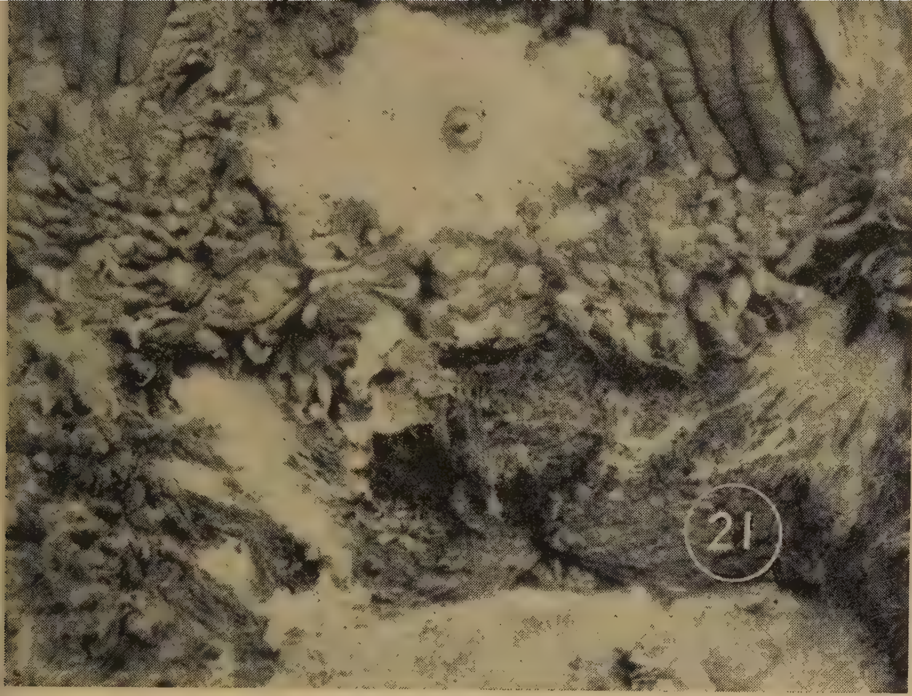


Fig. 21.—RINGING COMPLETED.

This enlarged close-up illustrates the area surrounding the pizzle free of wool and it wil be seen that the pizzle has been exposed and the edges of the shorn wool bevelled.

Compare this photo with Fig. 20.

Incorrect and Faulty Crutching

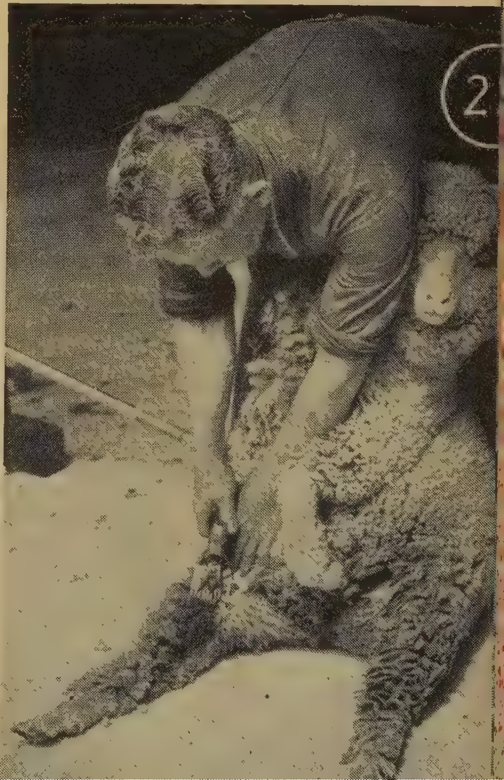
The following method of crutching which is prevalent in the agricultural areas is illustrated in a series of photographs showing some of the faults that occur when using this particular style.

Fig. 22.—COMMENCING BLOWS.

(WRONG)

The first and second blows are made outward on the inside of the right hind leg before touching the inner part of the crutch. This involves turning the machine against the drive to shear the bottom part of the leg. This is not good practice and there is always the danger of the sheep drawing the leg back towards the machine.

Compare with Fig. 1.



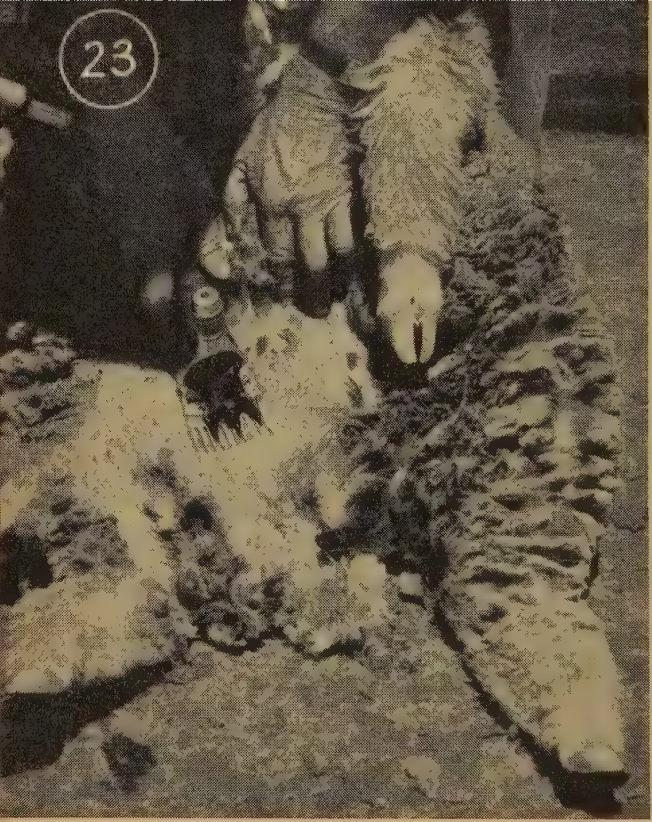


Fig. 23.—SHEARING DOWNWARD IN THE CRUTCH. (WRONG)

When shearing the inner crutch with **downward** blows there is always the two-fold danger of cutting the teats off and cutting the skin that wrinkles as the udder is pulled up. In addition the handpiece and down tube frequently come in to a straight line which lessens control of the handpiece.

Compare with Fig. 3a.

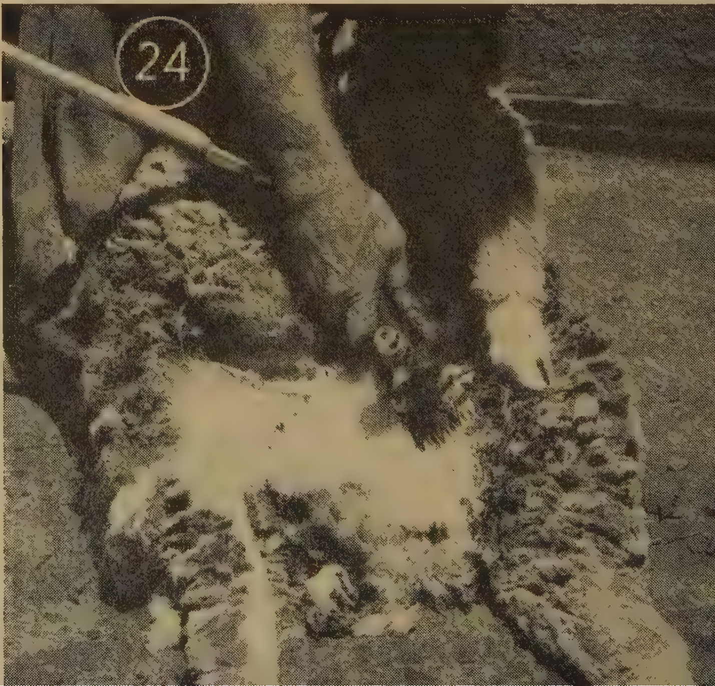


Fig. 24.—SHEARING INSIDE OF LEFT HIND LEG. (WRONG)

The wool on the inside of the left hind leg is next shorn out with two more blows, taking **eight to ten blows** in all to complete the inside of the crutch when using this style. By comparison this area is completed in **four blows** with the style as shown in Figs. 1-4.

Numerous short blows are very undesirable in shearing and result in a learner developing a bad poky style which once learnt can not easily be altered.

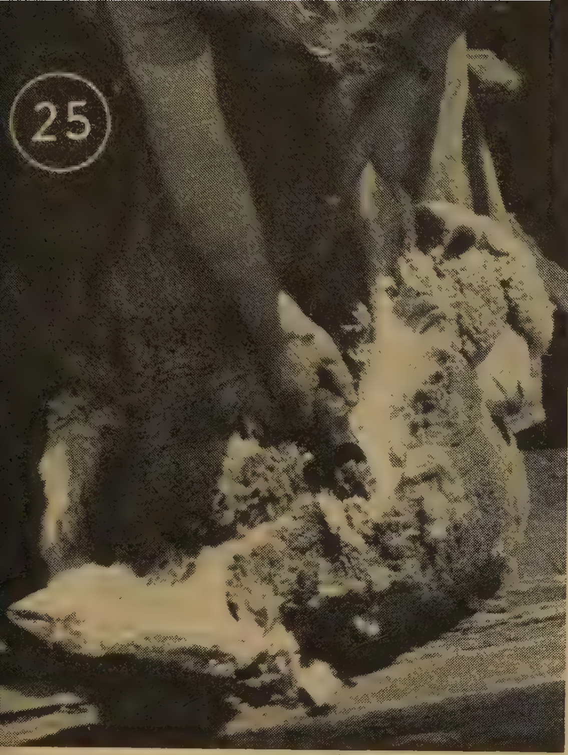


Fig. 25.—LEFT HIND LEG PULLED UP.

(WRONG)

The left hind leg is next pulled up and shorn downward bringing the sheep, with its head well pushed down, into a doubled up position which imposes added strain on both sheep and crutcher.

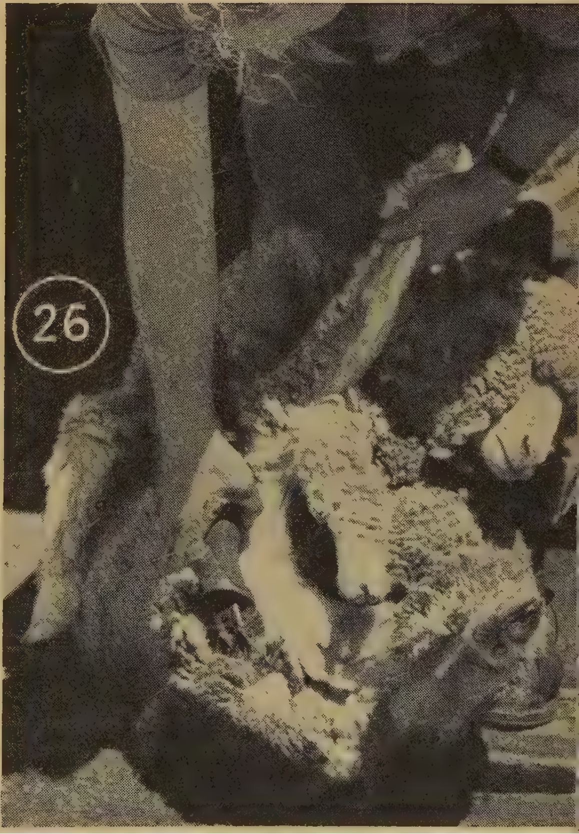


Fig. 26.—RIGHT HIND LEG PULLED UP.

(WRONG)

With the right hind leg next pulled up for shearing the doubled up sheep in these positions tends to become restless and to strain against the crutcher, who also has difficulty in cleaning over the tail of the animal.

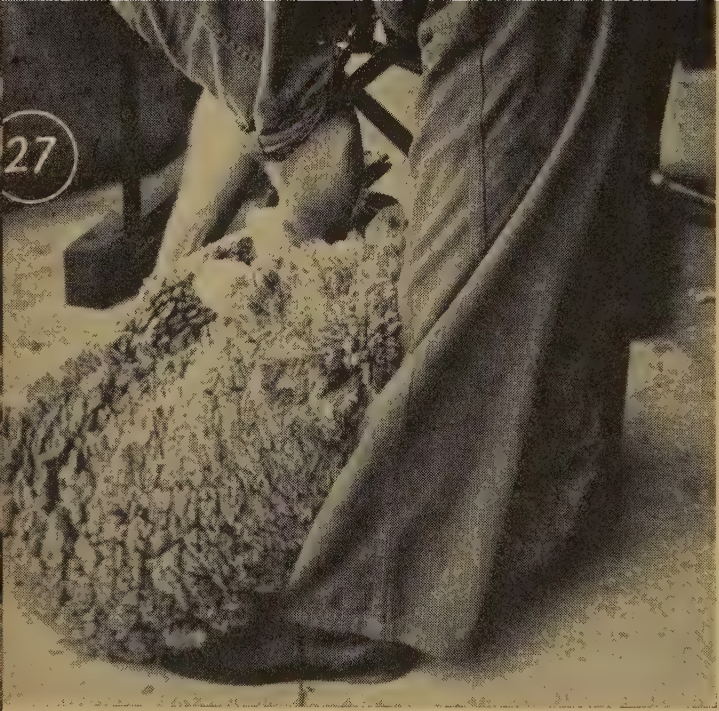


Fig. 27.—REAR VIEW OF FIG. 25.

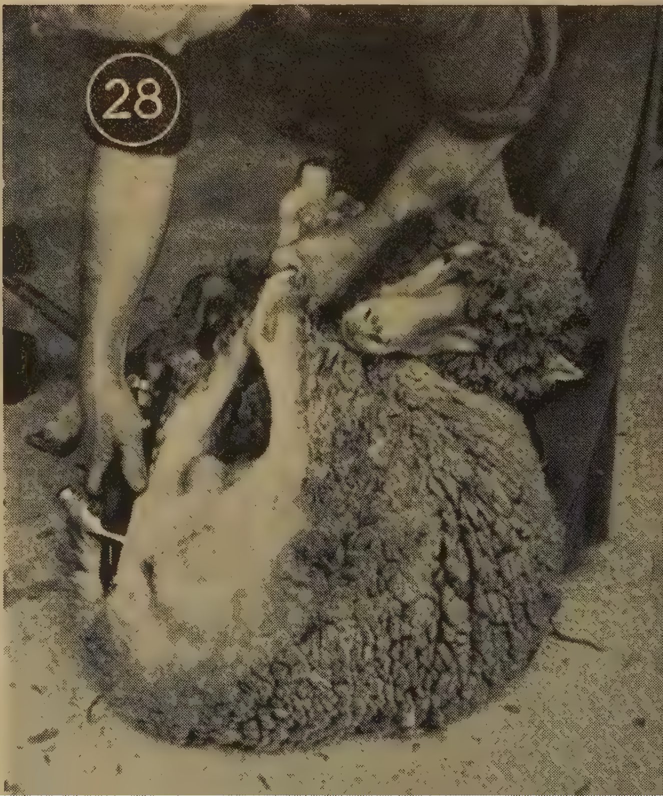
(WRONG)

This illustrates how the sheep is gradually working back through the crutcher's legs and only being controlled by the knee against the back of the sheep's head. It also shows the uncomfortable position of the sheep and the danger of losing control of the animal.

Fig. 28.—SHEARING OVER THE TAIL.
(WRONG)

In shearing over the tail, when employing this style of crutching, it is often necessary to pull up both legs as illustrated. This position can cause injury to the sheep, particularly to ewes heavy in lamb, and the resultant straining and kicking by the animal will force its head between the knees of the crutcher who will then have lost control.

Always remember that catching hold of a sheep's leg or legs is inviting it to kick and strain—which it usually does!



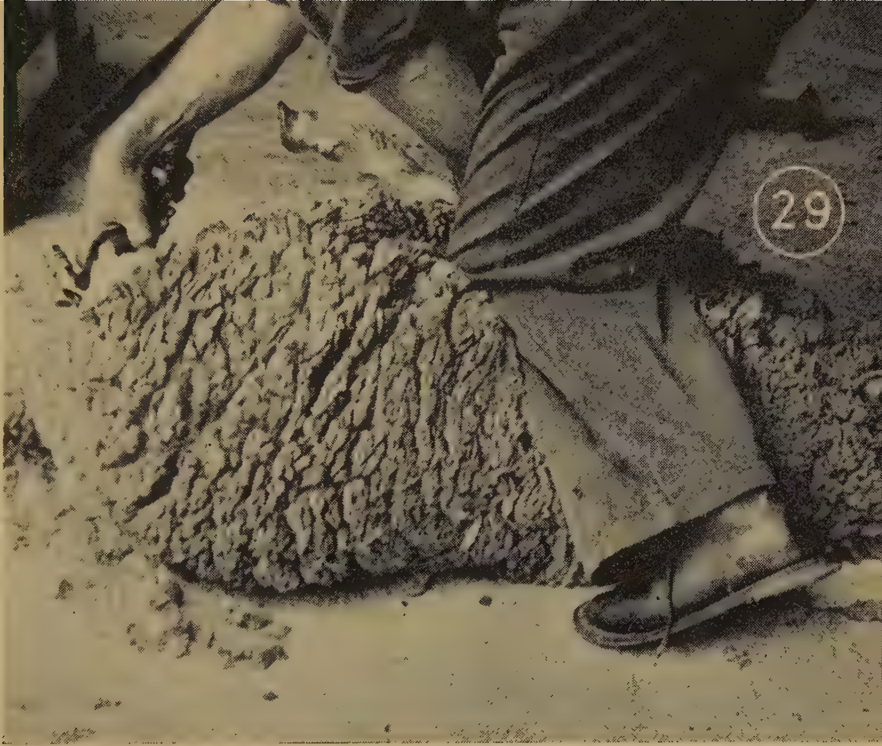


Fig. 29.—SHEEP OUT OF CONTROL.

(WRONG)

With the sheep out of control the crutcher has considerable difficulty in completing the crutching and is forced to kneel on the sheep to complete the work—frequently with most unsatisfactory results.

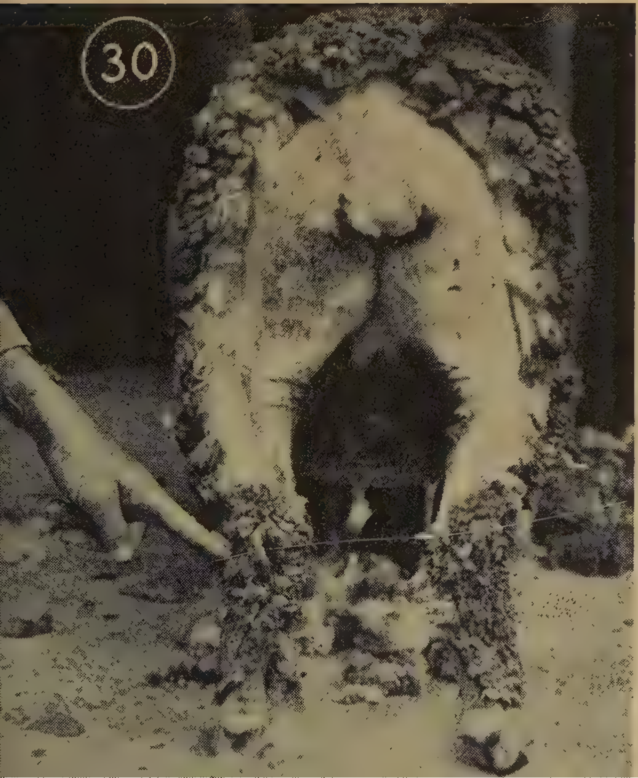


Fig. 30.—SHEEP INCORRECTLY CRUTCHED.

This sheep has been shorn too high over the tail and too wide at the buttocks which is unprofitable and relegates too much good wool to crutchings. It will be noticed that the wool has not been removed from the hocks and legs which will become stained and dirty and attractive to the fly.

Remember woolly hocks are excellent dung catchers!

Note the pockets and cover provided by the roughly shorn unbevelled edge.

Shearing too high over the tail, which appears to be a common mistake, is costly and unnecessary. The sheep does not throw the excreta and urine up over the back!

Compare with Fig. 15.

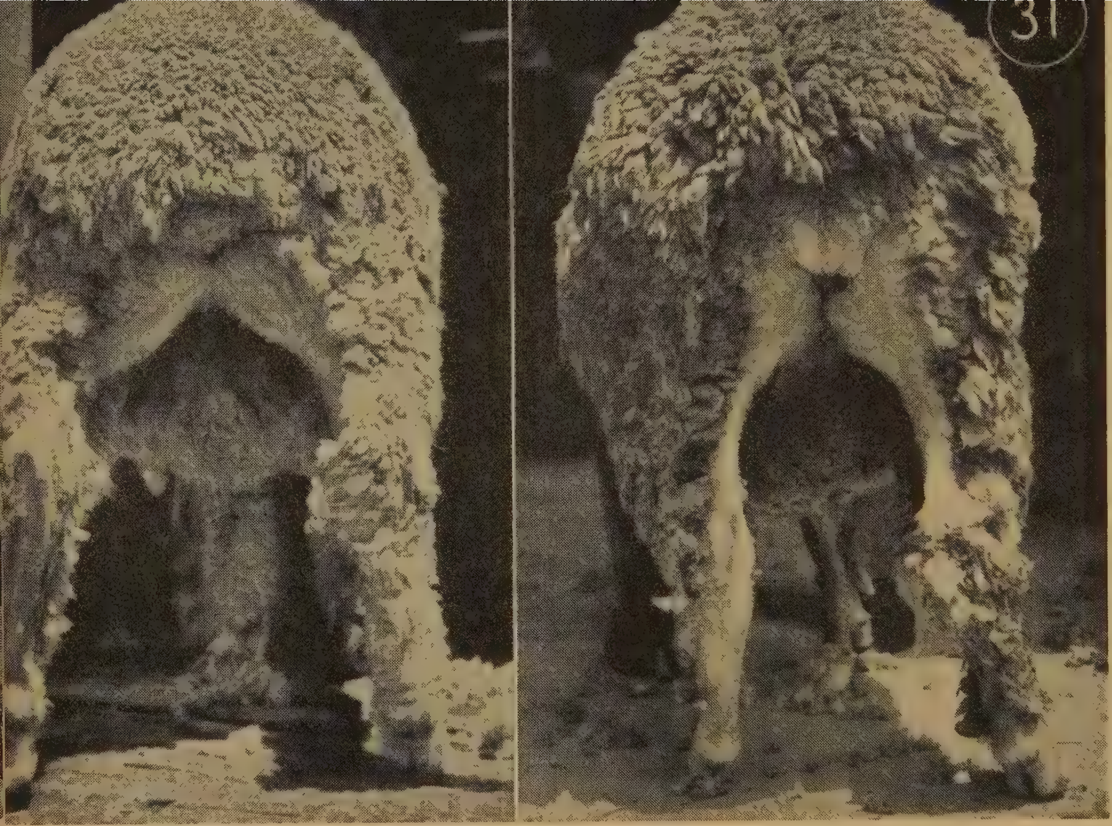


Fig. 31.—UNDERCRUTCHED.

(WRONG)

This illustrates typical undercrutching which is also common practice. The sheep has not been shorn high enough above the tail and the crutching is much too narrow at the buttocks. Note the wool which has been left on the right hock by comparison with the clean left hock.

Compare with Fig. 15.

Fig. 32.—OVERCRUTCHED. (WRONG)

This illustrates an overcrutched sheep that has had too much good wool removed through shearing too high and too wide over the tail and the buttocks. Despite this waste of **fleece** wool no more protection has been achieved than if the sheep had been correctly crutched.

Note the ragged unbevelled edges that can harbour maggots.

Compare with Fig. 15.

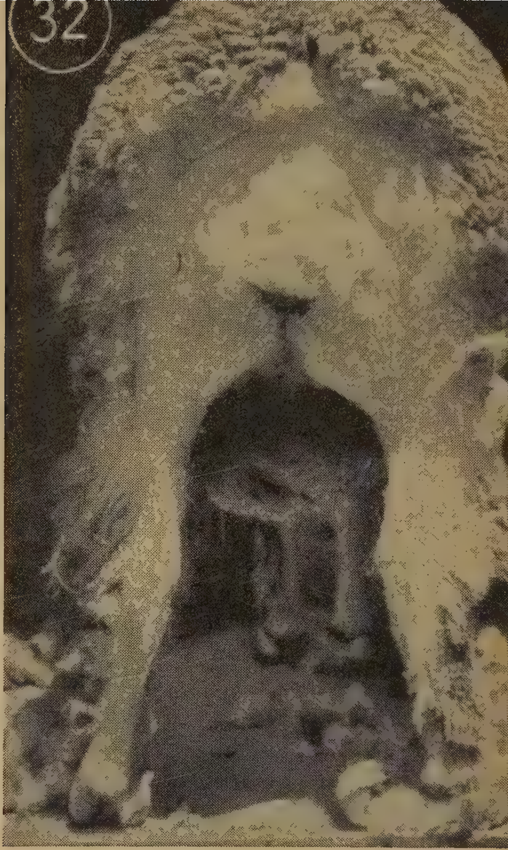


Fig. 33.—SORTED CRUTCHINGS.

The crutchings from the sheep shown in Fig. 32 have been sorted into two lines as illustrated. It would be more profitable to have obtained a **fleece** price for the heap of wool on the right, plus extra fleece weight, by leaving this wool on the sheep.

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HELP FOR THE MAN ON THE LAND

The Commonwealth Bank offers the most comprehensive range of trading bank services available in Australia. Such services include cheque accounts, finance for primary production and other facilities helpful to the man on the land.

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SEASONAL REMINDERS

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Veterinary Notes for May-June

By OFFICERS OF THE VETERINARY BRANCH

SHEEPMEN who have not already done so should lose no time in immunising their flocks against infectious entero-toxaemia ("pulpy kidney"). This disease may occur anywhere in the agricultural areas and is often prevalent during the flush season of the year.

Losses may be heavy, particularly in good seasons. Affected sheep usually die suddenly after an illness of short duration and are often found dead in the paddocks without any symptoms of sickness having been observed.

Within a few hours of death the carcass becomes greatly distended with gas; the flesh darkens rapidly and the wool plucks out readily. It should be noted that the symptom, pulpy kidney, which gives the disease its popular name, is a post-mortem change which is not observed in the fresh carcass but is very obvious three to four hours after death.

The disease may be prevented by inoculation with enterotoxaemia vaccine and this should be carried out just prior to the advent of green feed so that the greatest measure of protection may be provided during the period of greatest risk.

The vaccine is administered in a dose of 5 c.c. by subcutaneous (beneath the skin) injection and after an interval of 10-14 days produces an immunity which is usually sufficient to prevent losses for the remainder of the season.

HYPOCALCAEMIA

HYPOCALCAEMIA, also known as grass staggers or milk fever, affects both milking and in-lamb ewes and is particularly likely to occur during early seasons where there is a rapid and abundant growth of succulent green feed which coincides with lambing.

The grazing of lush green feed or young cereal crops favours the development of the disease and under such conditions the risk is greatly increased by droving or prolonged yarding.

Affected ewes show symptoms of shivering or trembling when driven; the gait is stilted and proppy and there is a watery discharge from the nose. This is followed by collapse and prostration.

Death usually occurs within a few hours of the onset of symptoms but may be delayed for two to three days. For the treatment of the disease the injection of a 25 per cent. solution of calcium borogluconate in a dosage of 60 c.c. is recommended and in the majority of cases this is followed by a rapid and often quite spectacular recovery.

Cartons of calcium borogluconate with directions for the preparation and use of the solution are readily available and it is advisable that a supply should always be kept on hand.

The prevention of hypocalcaemia is largely a question of management and in seasons which favour its occurrence especial care should be exercised in the handling of lambing ewes so as to avoid unnecessary driving or yarding for unduly long periods. Yarding overnight and driving to distant paddocks after release from the yards, should be avoided. Full particulars of the disease are given in Leaflet 1056, which is obtainable free of charge on application to the Department of Agriculture.

DISEASES ASSOCIATED WITH CALVING

WITH the advent of the calving season it is well to be on the lookout for diseases which are generally associated with calving, such as milk fever, after-calving paralysis, and acetonaemia.

Milk Fever as a rule occurs within a few days following calving, and generally affects mature cows, particularly heavy milkers. The cow goes down, usually lies on its brisket with the head turned into the shoulder, and generally goes into a coma. (See Leaflet 674).

After-Calving Paralysis usually occurs soon after calving also. There is a paralysis of the hind legs, but the animal remains bright about the head, and eats and drinks normally unless there are other complications.

Acetonaemia generally occurs during the first six weeks of lactation and is characterised by loss of appetite, reduction of milk yield, loss of condition, and constipation, and there may be a sweetish odour of breath, milk, and urine. There is also a nervous form of Acetonaemia. (See Leaflet 873).

In some cases milk fever may be prevented by incompletely milking out during the first three days, or allowing the calf to remain with the mother for that period. In highly susceptible cows, a calcium injection immediately following calving and repeated 24 hours later may prevent an attack. It is generally treated successfully with calcium borogluconate injections.

After-calving paralysis should be differentiated from conditions in which paralysis is due to injury at the time of calving, or to fractures of pelvis, etc. due to struggling or slipping. Injections of calcium and phosphorus will often get affected animals on their feet, but some cases may remain down for weeks before finally getting up.

Acetonaemia may often be treated successfully with chloral hydrate and molasses.

As these disease conditions are frequently complicated, the services of a veterinary surgeon should be obtained wherever possible.

THE MARTYRS

"LITTLE city abounding in faith and mystery and hope, why do your myriad virgins consent to a task that no human slave has ever accepted? Another Spring would be theirs, another Summer, were they only a little less wasteful of strength, a little less forgetful of self, in their ardour for toil; but at the magnificent moment when the flowers all cry to them, they seem to be stricken with the fatal ecstasy of work, and in less than five weeks they almost all perish, their wings broken, their bodies shrivelled and covered with wounds."

—"The Life of the Bee," by Maurice Maeterlinck.

Orchard Notes for May and June

By OFFICERS OF THE HORTICULTURAL BRANCH

IF it is intended to plant a leguminous cover crop this should be done without delay. It is not advisable to sow seed later than May. Details of cover crops appeared in the previous Journal.

PRE-HARVEST DROP OF CITRUS

The pre-harvest drop of citrus fruits particularly Navels and Grapefruit which occurs during the winter months may be largely prevented by the application of a spray containing 20 parts per million of 2,4-D. This material is marketed under the proprietary name of Kling-Cit. It should be applied as a cover spray to foliage and fruit some time before the drop is expected and may remain effective as long as six months. Avoid spraying trees when much young growth is present.

HARVESTING OF CITRUS FRUITS

Careful handling of citrus fruits is necessary to minimise the development of moulds in the stored fruit. Picking boxes should be carefully examined to ensure they are free from protruding nails and rough surfaces. When fruit is clipped, the work should be done carefully and if necessary a second clipping should be made close to the button. Long or rough finger nails can injure the skin of the fruit and these should be checked regularly.

During wet weather the fruit should be allowed to dry before packing. The same careful treatment recommended for picking should be continued through all subsequent handlings.

Strict attention should be paid to packing-shed hygiene, particularly with fruit affected with mould.

MARKETING OF CITRUS FRUITS DISEASE AND PEST CONTROL

Oranges, lemons and grapefruit must be marketed according to the Grading Regulations under the Agricultural Products Act and according to the provisions of the Fruit Cases Act. Details of the requirements are available at the Perth Office or from field officers.

Oranges should not be marketed at an immature stage. The maturity standard is 26 mils maximum and fruit not conforming to this requirement is degraded to "inferior."

Fruit packed for export must conform to the Exports—Fresh Fruit—Regulations. Extra care should be given to the preparation of export orders, as the fruit is expected to hold its condition and quality when received by the importer.

Packing charts for citrus fruits may be obtained from the Head Office of the Department or district Horticultural Instructors.

DISEASE AND PEST CONTROL

(a) Fruit Fly.—Although with the onset of cooler weather and winter rains fruit fly becomes less troublesome it is nevertheless advisable to put out bait composed of:—

1 oz. sodium fluosilicate.

2½ lb. white sugar.

4 gallons of water.

or the prepared mixture "Lurotox" during fine warm spells when the flies are usually to be found on the sunny side of the tree. Leaflets on Fruit Fly Control are obtainable from the Department of Agriculture, Perth.

(b) Brown Rot of Citrus.—If a spray has not already been applied this should be done as early as possible in May using a 4:4:40 Bordeaux mixture.

(c) Shothole of Stone Fruits.—If trees were badly affected with the disease during the past season a spray of 6:4:40 Bordeaux mixture is advisable when the leaves commence to fall.

PRUNING

The pruning of vines and stone fruits may be commenced in June. Wherever possible diseased wood should be removed and all prunings burnt to destroy overwintering fungal spores and insect eggs. It is important that all vine canes showing black spot lesions should be removed and burnt. Growers needing advice are advised to contact the district Horticultural Instructor.

Poultry Notes for May-June

By OFFICERS OF THE POULTRY BRANCH

ARRANGEMENTS should be in hand for setting up breeding pens. Breeders in particular should make a special point of hatching their future breeding birds (both sexes) from second or third year hens and wherever possible should use proven cocks. It is imperative that all birds on breeding farms, irrespective of their purpose, should be blood tested for pullorum disease prior to mating. For preference chickens should be hatched in June, July and August.

Incubators, brooder houses and rearing equipment should all be thoroughly cleaned. The incubators should be fumigated before any eggs are set. All brooder houses and rearing equipment should be disinfected—the walls with five per cent. Dettol and the floors with a solution of 1 lb. of caustic soda to five gallons of water or 10 parts of ammonia to 100 parts of water. The floors of the brooder house should be covered with clean dry sawdust to a depth of three inches before the chickens are housed.

Rape is an excellent cover crop in brooder runs and this crop should be sown six weeks before the day-old chicks are delivered.

A cereal crop should be sown in the rearing pens six weeks before the chickens are transferred to them.

Coccidiosis. — Supplies of either sulpha-quinoxaline or sulphamezathine should be on hand prior to the delivery date of chickens. This applies especially to producers in country districts.

Feed.—All laying stock should be receiving a diet which contains 16 per cent. of protein. In view of the shortage of whalemeal and meatmeal a proportion of the animal protein used may be substituted with whale solubles (see Departmental leaflet).

If adequate greenfeed is not available a fish oil rich in Vitamin A should be fed at the level recommended by the manufacturer. Where possible, some greenfeed should be fed to maintain yolk colour. **This is important.**

If birds are intensively housed and sunlight is limited, they should be receiving a Vitamin D3 rich fish oil. This applies especially to chickens during the brooding period.

Lighting.—If you are using electric lights the times of switching on should be checked to see that the laying hens are receiving 15 hours of light per day.

Culling.—Odd pullets will break down during this period and these birds should be marketed.

Tobacco Notes for May and June

By T. G. HANEY, B.Sc. Agric., Tobacco Adviser

IF land has not already been prepared for the next season's crop, it should be ploughed when moist enough, preparatory to sowing of green manure crops. The recommendation, especially for new land, is to sow a mixture of a leguminous crop, such as lupins or field peas, with oats. Sow one bushel of each, or where no legume is to be used, sow oats at the rate of two bushels per acre. One cwt. of superphosphate per acre is the recommended application of fertiliser.

Tobacco stalks should all be pulled and burnt by May 30. A suggestion to make the pulling of stalks easier, is to remove the mouldboard from the plough, and run along the sides of the plants with the share. This method pulls the plants out of the ground to a certain extent and loosens the soil around the roots. When carrying out this operation, observe the root systems. Several cases of nematode infestation have been found in the area and the disease is quickly spread by ploughing and cultivation. If severe patches of nematode infestation are found, these can be treated early, thus preventing excessive spread.

GRADING HINTS

Grading should be in full swing by this time. There will be two sales this year, on August 14 and 17. At least 250 tons will be required for the first sale, so a good majority of this leaf will need to be in Fremantle by July 14. All leaf must reach Fremantle by August 14. Grading is merely a matter of comparison of leaves. In general, the division between grades is too fine. If bottom, middle and top leaves are kept separate, there should only need to be about half a dozen grades from each bulk. If this is done, grading for size can be carried out in the same operation, thus preventing double handling of the leaf. Two sizes, longs and shorts, only are necessary. The practice of grading into longs, mediums, and shorts is unnecessary.

PREPARING FOR SALE

When tying leaf, don't make the hands too big and untidy. Neat, tightly-tied hands in the bale make a much more attractive sight than loose, big hands. This may also mean extra pence per pound for the grower.

It is most important to try to avoid divisions in bales. If they are necessary, keep leaf within the bale of similar grades. It is not wise at any time to have more than one division. If only a small amount of one grade is available, it is better to include it with the next grade, rather than divide the bale.

Put the correct number of hands in for tie layers so that the bales don't bend.

When baling, be sure that leaf is not too moist. Once leaf comes under pressure in the press, moisture in the leaf becomes much more apparent. Therefore, have just enough moisture in the leaf to be able to handle it. Leaf which is too "soft" is too prone to develop mould, and if it has not already done so by the time it reaches the floor, more expense is incurred by the re-drying and repacking which becomes necessary. Mouldy leaf is "taboo" to buyers.

Lastly, keep bales a reasonable size—150 lb. is the optimum size, but variation is between 100 and 200 lb. Bales over 200 lb. are repacked on the floor. Leaf in small bales is apt to be badly damaged in transit, and often arrives at the factory as a mass of broken leaf.

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Wheatbelt Notes for May-June

MAY is the main seeding month in the wheatbelt and varieties of cereals should be sown according to their maturity and suitability to the particular district.

Too early sowing of the early-maturing varieties is likely to result in outbreaks of septoria or may result in the crops being damaged by frost injury in the spring. See the departmental recommendations for the varieties best suited to your district and rainfall.

When seeding cereals, the best results will be obtained from seed sown in a moist well consolidated seedbed following the destruction by cultivation of early germinated weeds. Use seed of early and very early varieties, according to district, when conditions cause seeding to be extended later than normal. Apply superphosphate at the rates recommended for your local conditions, always remembering that crops on old land which has in the past received substantial dressing of superphosphate, will grow successfully following upon smaller dressings than usual. Give the heaviest dressings of superphosphate on the newer land wherever possible.

Avoiding Webworm Damage.—Seeding of wheat crops on pasture land should be delayed at least two weeks after ploughing in order to minimise the risks of damage by webworms. At the completion of seeding time, clean and store seeding machinery under cover and list any new parts required.

If possible commence your fallowing during June as early fallow is better than late fallow in the drier areas.

Wash superphosphate bags as soon as they are emptied as they are a valuable asset in these days of jute shortages.

Sheep Notes.—The tailing and marking of the lamb crop will be carried out during these months. Choose a warm dry day and avoid placing the lambs on rank wet grazing after the operation. Use sharp instruments, antiseptics and erect temporary yards in clean paddocks to minimise the danger of tetanus and other infections. The long tail (three inches) reduces the risk of fly-strike.

Lay poison baits for foxes and wild dogs prior to, and during the lambing period.

Watch for fly-strike during June as an early flush season may produce an early winter fly wave.

Pastures.—Avoid over-grazing of pastures just after the plants have germinated. It is better to continue hand feeding until pasture growth has made some progress.

Rotate grazing wherever possible, as pastures can become fouled and stale. Stock do better on fresh grazing and frequent changes.

Fumigate and destroy rabbit warrens during the winter months.

CHART FOR PACKING APPLES

A chart giving details of the correct method of packing apples is now available at the Department of Agriculture, Perth, or from District Officers. This chart embraces packs for apples of various shapes, such as round, flat, long and medium long types with brief explanatory remarks.

It is printed in two forms; a wall-type chart for packing-shed use and a small pocket-size folder.

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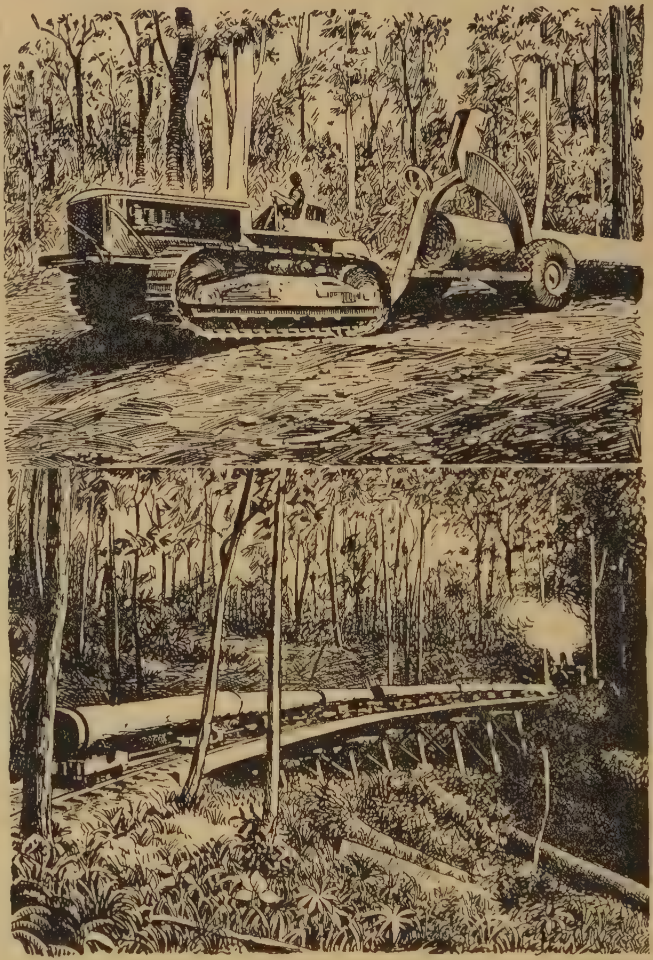

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PLANT Diseases

By W. P. CASS SMITH, B.Sc. Agric.
(Government Plant Pathologist)

BROWN ROT OF CITRUS

BROWN rot is a serious disease of citrus, which fortunately has proved to be readily controllable. It attacks both leaves and fruits causing partial or complete defoliation, and a rather characteristic fruit rot. The disease may also affect the bark of citrus trees in the basal trunk region resulting in "collar rot," or as it is sometimes called, brown rot gummosis. This phase of the disease will be referred to later.

The parasitic fungi causing brown rot* are favoured by abundant moisture and thus liability to the disease is greatest in the wetter areas, particularly where the soil is heavy or poorly drained. Brown rot occurs commonly in various localities in the Darling Ranges and coastal plains and especially in low-lying areas subject to flooding, or kept moist by seepage or poor drainage.

Orange, mandarin, and lemon trees are very susceptible and the disease has also been noted infrequently on grapefruit.

LEAF SYMPTOMS

Affected leaves develop dark water-soaked areas, which generally extend either from the tips downwards or from the edges inwards. Very occasionally a leaf may be attacked centrally without involving the margin.

Diseased leaves curl somewhat and fall readily while still green and healthy-looking over the greater part of their surfaces. This defoliation is generally the most obvious sign of the disease in its early stages, or in mild attacks.

Typically, brown rot infects the lower leaves first, and spreads upwards to higher branches, and usually infections are most numerous on the sides of the trees sheltered from sun or wind, which remain moist longest after rain.

FRUIT SYMPTOMS

Affected oranges and mandarins develop a dull, dark brown area usually on one side, which may spread until the whole fruit is involved. The rotted areas remain firm to the touch unless invaded by secondary organisms, and have a penetrating and characteristic odour unlike that usually associated with mouldy citrus fruit. In the absence of secondary infection brown rot affected fruit eventually shrinks to a

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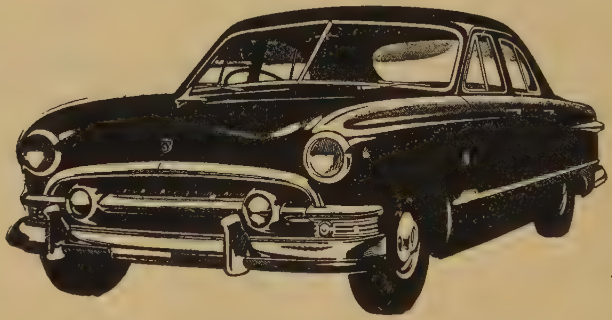
* Phytophthora hibernalis and Phytophthora citrophthora.



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dry hard mummy. Usually in the orchard however, secondary infection with common moulds such as Penicillium spp. eventually occurs resulting in a soft breakdown of the whole fruit.

The first infected fruits are usually the lowest ones, near to or in contact with the soil, but as the disease progresses infected fruit may be found at higher levels. In general however, the disease is progressively less abundant towards the top of the tree. Brown rot may also spread by contact between diseased and healthy fruits. Affected parts of lemon fruits develop a washed-out, pale yellow or almost white colour, which contrasts sharply with the brighter yellow of the sound skin.

As with oranges the affected areas eventually turn brown, and in the rare absence of secondary infection, diseased fruits shrink and dry.

TWIG BLIGHT

When leaf infections are numerous and severe defoliation results, the smaller twigs and branches often die. In consequence the yield of fruit on affected trees may be greatly reduced in the following season.

CONTROL

1. Prune the trees so that the lowest branches are at least a foot above soil level when weighted with fruit, and thin out any excess branches. Also keep down tall weed or cover crop growth underneath the spread of the branches.

2. Before the autumn rains commence, say from the middle to the end of April, *thoroughly* spray the lower two-thirds of the trees with Bordeaux Mixture 4:4:50 plus a spreader such as prepared white spraying oil 1:80; or calcium caseinate ½ lb. in 50 gallons. The latter spreader would be preferable in areas where liability to water spot and rot is high. To ensure thorough coverage the foliage should be sprayed from below upwards, as well as from above downwards. Also to reduce the amount of the fungus in the surface soil, and guard against "brown rot gummosis" or collar rot, the soil under the spread of the branches, and the butts of the trees should be well drenched with spray. Where mottle leaf due to zinc deficiency is prevalent zinc-copper-Bordeaux mixture may be used for the control of both troubles simultaneously. In this case, half the powdered bluestone, should be replaced with an equal weight of zinc sulphate when preparing the Bordeaux mixture.

3. To guard against further infection in spring, spray the lower two-thirds of the trees with Bordeaux 4:4:50 plus spreader in late winter or spring, say in the first or second week of August. This spray is particularly important for lemon trees, which usually are more subject to the disease in spring than during the winter months.

4. Where spraying at the times stated has been neglected and the disease has broken out, spraying should be done at the earliest opportunity, i.e. during the first period of fine bright weather.

5. Fallen diseased fruits and leaves if left under the trees favour the development of the fungus in the soil, and increase the chances of further infection. They should therefore be gathered up and destroyed.

SPECIMENS HELP DIAGNOSIS

WRITTEN descriptions of plant diseases are often insufficient for accurate diagnosis. Send specimens, preferably several, showing the disease at various stages. They will usually carry well if wrapped in moist newspapers and enclosed in well-ventilated containers.

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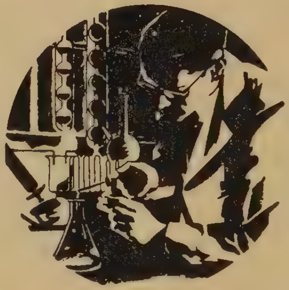
COLAS
SHELLTOX
SHELL DDT BLOWFLY DRESSING
SHELL MOTOR OILS & GREASES
SHELL SPRAYING OILS
PENNANT KEROSINE
CROSS POWER KEROSINE



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COLLAR ROT OR BROWN ROT GUMMOSIS OF CITRUS TREES

COLLAR rot or brown rot gummosis is a disease which kills the bark of citrus trees in the basal-trunk or collar region. It is caused by a parasitic fungus* which is also partly responsible for the brown rot disease of citrus leaves and fruits.

The parasite usually infects the bark near the soil line and spreads both upward and around the trunk. It seldom progresses downward beyond the union on to the roots except in the case of seedling trees. As a result of its activities the invaded bark is killed and often quantities of gum are exuded. Later the dead bark dries and shrinks causing bark cracks to appear which run parallel with the trunk. (Fig. 1.).

Gum exudation, and the occurrence of longitudinal bark cracks are usually the symptoms by which collar rot infection is first noticed. As the disease progresses however, and more extensive areas of bark are killed, the foliage yellows and the tree becomes unthrifty in appearance. In the absence of treatment ring-barking and death of trees usually occurs although occasionally trees may recover naturally.

Wet conditions favour the occurrence of collar rot and thus it is most prevalent on heavy or poorly drained soils, in the wetter areas. Of the citrus varieties, lemons are by far the most susceptible, followed by grapefruit, navel and valencia oranges, and mandarins. The rough lemon or citronelle rootstock on which the majority of our citrus trees are "worked" is less susceptible than lemon or sweet orange varieties and it is for this reason that collar rot usually makes slower progress below than above the bud union. Seville or sour orange rootstock is even more resistant than citronelle, and according to New South Wales experience, trifoliata stock is immune.

CONTROL MEASURES FOR COLLAR ROT OR BROWN ROT GUMMOSIS

Preventive

Probably under local conditions the main factors contributing to collar rot attack are:—

(a) Excessively wet soil; (b) deep planting; (c) accumulation of infectious material in the soil surface.

Wet soil conditions encourage the causal fungus and hence adequate drainage should be provided. Skirting the trees so that there is at least a foot of clearance between the lowest branches and the ground, facilitates air movement and sunlight penetration and thus promotes more rapid drying of the surface soil and tree trunks. As the bark of lemon and sweet orange varieties is more susceptible than the citronelle stock on which they are commonly "worked", deep planting or the piling up of soil around the trunk should be avoided. Trees should be planted so that after settling in the soil the bud union is well above ground and the main crown roots are as near the surface as possible.

As the fungus causing collar rot is also partly responsible for brown rot, particularly of lemons, liability to collar rot attack is increased when brown rot affected leaves and fruits are left lying on the ground. They should therefore be gathered up and destroyed, and when routine sprays are applied for brown rot control the butts of the trees and the soil under the branches should be well drenched.

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* Phytophthora citrophthora.

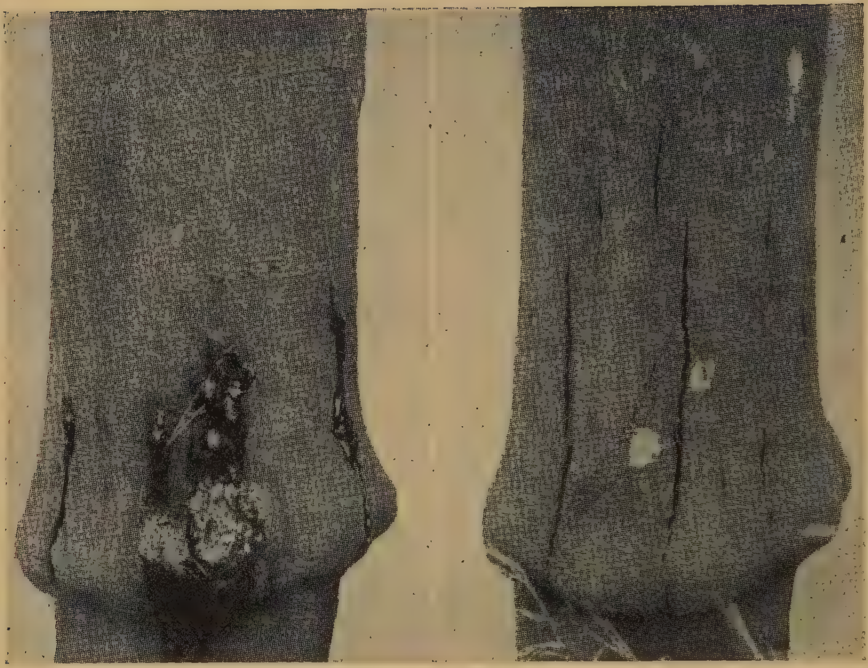

Fig. 1.
Collar rot or brown rot gummosis on lemon tree. At left, early stage of disease showing gum exudation. At right, same tree at a later stage. Note that the gum first formed has been dissolved by winter rains, and the dead bark has dried and shrunk causing bark cracks. (After Fawcett.)

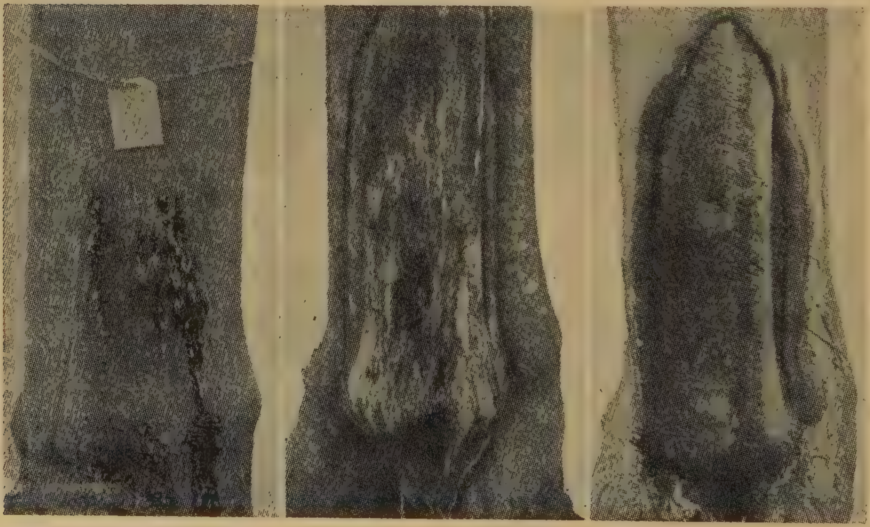

Fig. 2.
Showing curative treatment of collar rot or brown rot gummosis: At centre, the diseased bark and a small surrounding strip of live bark has been cut away ready for painting with Bordeaux paste. At right, same tree two years later, showing healing of wound at edges, and covering of asphalt paint on the exposed wood. (After Fawcett.)

Curative

When collar rot is first noticed, the soil should be removed from around the butt of the tree and the bark scraped lightly to ascertain the extent of infection. The diseased bark may be differentiated from the healthy bark by its darkened, brownish colour. With a heavy knife cut out the dead bark and also an inch or two of live bark surrounding this area. The disease does not penetrate deeply so it is only necessary to cut away the bark and not the woody tissue below. To assist rapid callousing bring the cuts to a point, both above and below, as indicated in Figure 2.

If the infection has spread below the union on to some of the roots, they should be treated in the same way, or if very badly diseased, removed completely.

Finally to assist healing and prevent secondary infection with wood-rotting fungi, or other organisms, the wounded surfaces should be coated with Bordeaux paste. The coating should be renewed as required by weathering, until the cut edges begin to heal, when it may be replaced with a good seal of asphalt paint or other permanent wound dressing. Bordeaux paste may be prepared according to the following formula: Powdered copper sulphate 1 lb., quicklime 2 lbs. (or good quality hydrated lime 3 lb.), water 1½ gallons.

Dissolve the copper sulphate in 1 gallon of water, and slake the quicklime in the remaining ½ gallon. Then pour together and stir thoroughly before using. When not in use the mixture should be kept in a closed container.

When trees are so badly affected by the disease, that they would be ringbarked by the surgical removal of the dead bark, they may sometimes be saved by bridge-grafting or inarching. In this case the local Horticultural Instructor should be consulted regarding treatment.

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WESTRALIAN FARMERS CO-OPERATIVE LIMITED

ELEPHANT GRASS

(Pennisetum purpureum–Schum)

By H. G. ELLIOTT, Dip. Agric. Assistant Superintendent of Dairying
and
L. C. SNOOK, D.Sc., Animal Nutrition Officer

(Revised from Leaflet No. 600, by H. G. Elliott)

ELEPHANT Grass, sometimes known as Napier's Fodder, is a hardy, palatable and nutritious plant which under good conditions will give heavy yields. When once established it will remain as a permanent stand so long as it receives good treatment. It grows well in many parts of Western Australia and up to date appears to be free from attack by pests and diseases.

It was first introduced into Western Australia in 1916 by Mr. A. Crawford, then Chief Inspector of Rabbits, Department of Agriculture, who obtained a small sample of seed from Rhodesia, Central Africa. The seed was planted in his garden at Claremont and only one germinated. From the resulting plant supplies have been distributed over Western Australia.

Several cuttings were grown by the late Mr. W. Catton Grasby in 1917, and some idea of the rapidity with which the plant multiplies can be gained from the fact that he distributed 4,000 cuttings in the spring of 1918 to farmers in various districts of the State.

In the "Agricultural Gazette" of New South Wales for October, 1916, there are some notes on trials of this grass made in the Sydney Botanical Gardens and elsewhere in that State. Mr. E. Breakwell, B.A., Agrostologist, stated that under Sydney conditions, the trial showed that the grass is hardy and palatable, and made good growth in the winter months. Up to the time of writing, seed had not developed, but no difficulty had been found in growing the grass from rooted slips or cuttings. In Rhodesia it has the reputation of being "drought resistant, capable of enduring winter conditions and adapted to light soils," and this has been confirmed in New South Wales, but the results were at the time of the report inconclusive.

HABITAT

The species is a native of tropical Africa, where it has a very wide range between 10 degrees N. Lat. and 20 degrees S. Lat. The northern limit runs from Sierra Leone through the great equatorial forest zone to the Cameroons, thence to the Nile, Lake Victoria and British East Africa. The southern limits run through Angola to Katanga, thence across the middle Zambesi to Eastern Rhodesia as far east as Beira. Within this immense area it occurs principally along watercourses and in marshy depressions, but occurs also in the well-lighted forest areas. It often forms reed jungles. In the drier savannahs of East Africa it is rarely more than six feet high.

In Western Australia, under drier conditions than in its native habitat, six to eight feet is considered a good growth.

The grass has been under notice in Africa since 1905, and is considered one of the best fodder grasses there, where it has been tested under severe conditions for some years.

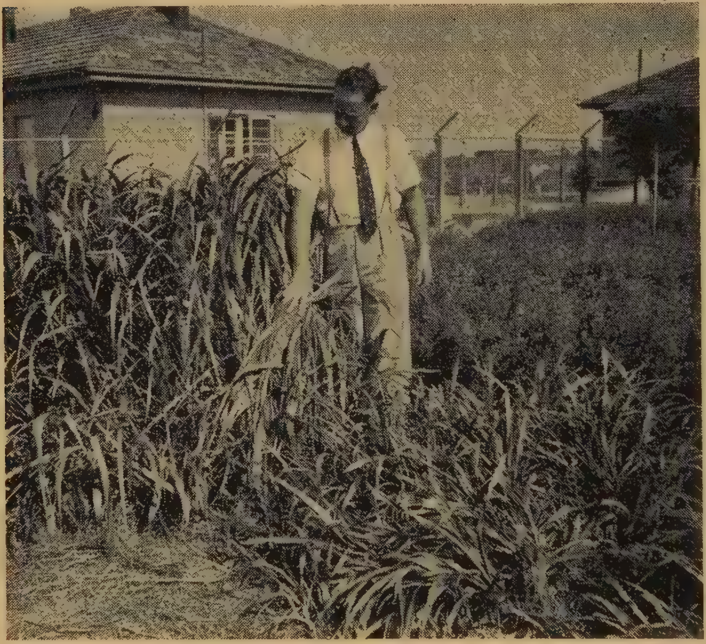

Fig. 1.—Elephant grass planted three years ago at the Animal Health and Nutrition Laboratories. This grass has been cut frequently and the tall plants in the photograph shows 35 days' growth since cutting. The short plants are of 10 days' growth.

HABIT

Elephant grass *(Pennisetum purpureum)* is a coarse grass when mature, and is characterised by extremely rapid growth under moist and warm conditions. It grows in clumps which stool prolifically, and is thus usually planted in rows from four to six feet between the plants.

Mature leaves, which attain a length of 2-2½ feet are coarse, but, when the plant is grazed or cut, the young shoots, until the plant reaches a height of three feet, are soft, succulent and relished by stock.

There appear to have been several distinct strains evolved, differing in such characters as hairiness of leaf and stem, height at maturity, etc.

SOIL REQUIREMENTS

Good stands may be seen on coastal soils at Karridale, on the heavy "black" clays of the Kimberley and on "sandplain" in parts of the wheat belt.

Being a deep rooted perennial, elephant grass will not thrive in waterlogged soils nor where there is a "hard pan" preventing root penetration.

Because of its hardiness there is a tendency to plant elephant grass in the least productive areas of the farm, hoping it will grow where other crops fail. This is quite the wrong attitude.

FERTILISER REQUIREMENTS

Knowing that elephant grass will give heavy yields of nutritious fodder for nine months year after year, it should be planted on the best ground available and generously fertilised. Only by such treatment can full advantage be taken of the plant's ability to grow rapidly. The stand should receive two cwt. of superphosphate per acre yearly and as much organic manure as can be supplied. When grown under irrigated conditions, heavy yields of high quality material can be obtained.

CULTIVATION AND METHODS OF PLANTING

As seed is not available, propagation is carried out from roots or cuttings made from mature cane. The rooted plants are preferable as these become established with the minimum of effort.

For planting large areas, however, it may be easier to use cuttings containing three joints, as these can be prepared with less labour and strike well if planted under favourable conditions. If planted four feet apart, with five feet between the rows a little over 2,000 cuttings are needed per acre. Fortunately one planting will provide a crop for many years.

Elephant grass would be more extensively grown if it could be established from seed. Unfortunately the flowers which are produced in Southern Australia are mostly sterile. It is possible, however, that seed may be grown commercially in tropical areas and tests will be made with plants now growing at the Kimberley Research Station on the Ord River.

Where elephant grass is required to grow without irrigation it may be preferable to plant out roots with the first autumn rains. The plants will make some growth before the cold weather sets in and even if bitten by frost will be ready to get an early start with the first warmth of spring. A succession of severe frosts may kill elephant grass plants in the first winter after planting, but well-established tussocks can survive long periods of cold weather.

Elephant grass is very drought-resistant and, once established, will yield a surprising bulk of greenstuff without summer watering. It is advisable to cut young plants regularly as soon as they are growing vigorously. If uncut there is a tendency for one or two spindly canes to develop flower heads, whereas cutting will encourage stooling. For example, rooted plants which were put out in September at the Animal Health Laboratory, Nedlands, had stooled out to cover areas of up to two feet in diameter in nine months.

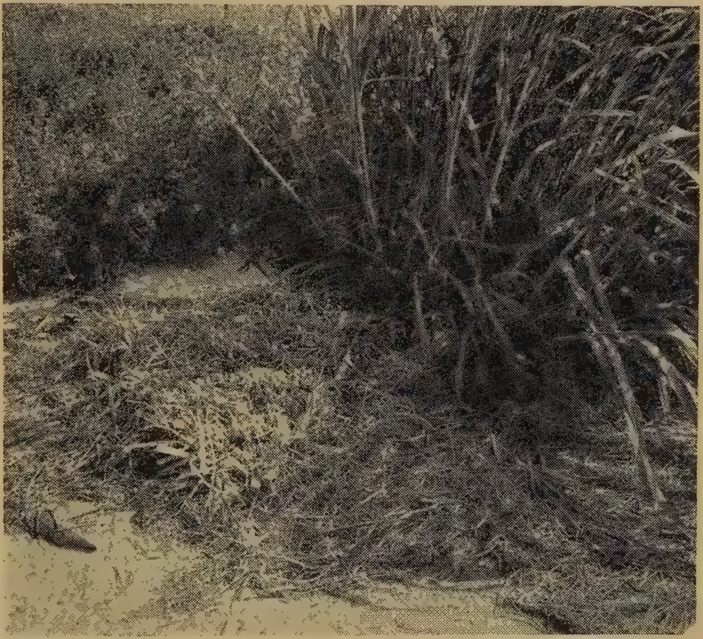

Fig. 2.—A photograph indicating the method of cutting at three to four weeks before the material has become fibrous. Half the tussock in the foreground had been cut when this photograph was taken.

VALUE AS A FODDER PLANT

Where ample moisture is present, elephant grass has a remarkable rapidity of growth and stooling characteristics and can be cut four to nine times in one season and will produce up to 50 tons of green fodder per acre. It is highly palatable, but becomes coarse if allowed to grow too high. It should be cut when about three feet high. Analyses show the value of this grass and figures for Sudan grass and maize are given for comparison:—

	Water.	Crude Protein.	Fat.	Carbo-hydrates.	Indig. Fibre.	Ash.
Elephant Grass (N.S.W.)	63·82	3·25	0·41	15·71	14·01	2·80
Sudan Grass	63·9	2·0	1·1	21·5	8·4	3·1
Maize, Green	76·9	1·9	0·6	13·9	5·5	1·2

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YIELD

Elephant grass, when correctly managed, gives very heavy yields of green material. For example, in September, 1949, roots were planted four feet apart each way in deep sand at the Animal Health Laboratory, Nedlands. From January onwards these plants were cut to ground level every three to four weeks. No estimate was made of the yield during the summer months when growth was at its best, but on 1st June the green material was weighed from a row of plants previously cut on 1st May. The average yield per plant was 10lb., which is equivalent to 12 tons of green fodder per acre, this being obtained despite unusually cold days during the growing period of one month.

This green material contained 24 per cent. dry matter. In other words, the crop yielded the equivalent to three tons of hay per acre. This was the seventh cutting from "slips" planted the previous September. Admittedly the crop was given ample water through sprinklers and was well fertilised, but the fact remains that it was grown on poor coastal sand which previously grew very little herbage even in the winter months.

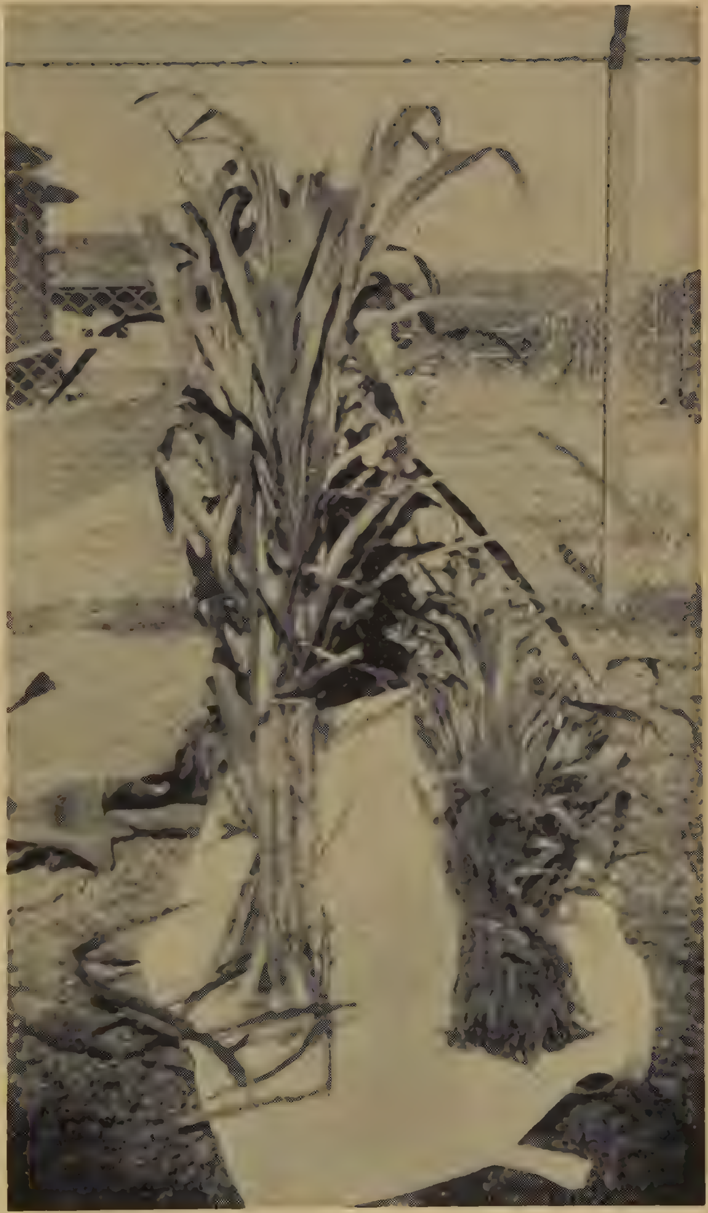

Fig. 3.—Contrast between young and old growth from elephant grass established in adjacent rows. Left—two months' growth containing 11 per cent. protein and 30 per cent. fibre. Right—Two weeks' growth containing 19 per cent. protein and 22 per cent. fibre.

COMPOSITION

Elephant grass stands if correctly managed will yield a high protein fodder. For example, the May cutting from the laboratory plot at Nedlands was very nutritious containing 24 per cent. protein in the dry matter and a stand of young elephant grass should be con-

ELEPHANT GRASS—COMPOSITION AT VARIOUS STAGES OF GROWTH.

Grown at Animal Health Laboratory, Nedlands. Deep coastal sand.

Date Sample Cut.	Description.	Composition as a Percentage of Dry Matter.			
		Crude Protein.	Crude Fibre.	Calcium as Ca.	Phosphorus as P.
22–12–49	Two weeks' growth after cutting to ground level. Robust plants in second year	19	22	0·94	0·42
22–12–49	Two months' growth after cutting to ground level. Robust plants in second year	11	30	0·53	0·35
....	First cutting of summer growth. Robust plants in second year	7	31	0·40	0·30
1–6–50	One month's growth after cutting to ground level. "Slips" planted out in September, 1949	24	22	0·45	0·65
	For Comparison.				
29–8–47	Green lucerne, one month's growth. Animal Health Laboratory, Nedlands	24	20	1·73	0·47
Nov., 1947	Good quality meadow hay (subterranean clover and grasses), Margaret River area	13	28	0·90	0·19
....	Good wheaten and oaten hay, Western Australia	6	28	0·15	0·17
....	Wheat bran, Western Australia	15	10	0·08	0·65

sidered more as a protein-rich concentrate rather than as a roughage.

All pasture plants vary greatly in composition according to stage of growth and management. This is particularly the case with rapidly growing plants which become coarse and fibrous as they mature. Many growers, particularly poultry farmers, who have grown elephant grass, have made the mistake of letting the plants become too large before cutting. The effect of age on quality is shown very clearly in Table I, although the most mature sample there recorded was still soft and palatable by most standards. It is obvious that if greenstuff rich in protein and phosphorus is required, frequent cutting of elephant grass is essential.

With most plants frequent cutting reduces yield, often to a serious degree. Where bulk is of more importance than quality, as would be the case if feeding store cattle, it would pay to let the elephant grass grow for some months before cutting. Milking cows and laying hens, however, need food rich in protein and young elephant grass would be more valuable than a greater bulk of mature herbage. Just how often the stands should be cut to strike the best balance between yield and quality has yet to be determined. From experience at the laboratory, however, it seems that heavy yields can be obtained throughout the summer from well-tended elephant grass despite cutting every three to four weeks.

In cutting elephant grass it is advisable to use a scythe or mower so as to remove the growth down to ground level. If canes are cut some distance above the ground, dead woody butts tend to accumulate, which interfere with cultural operations and reduce the plant efficiency. Cutting at ground level also tends to encourage underground suckering and the spread of the plant. With regular cutting, the stems are soft and make easy work for a scythe or mower.

GRAZING

It is generally assumed that elephant grass is a crop requiring considerable labour to harvest the green material. Once the plants are firmly rooted, however, strictly controlled grazing could be carried out. The grazing animal would be admitted to eat down the greenstuff as quickly as possible, then removed for three weeks or more for the plants to recover. Elephant grass is so palatable while young that stock would soon kill the plants if allowed to graze continually.

Under certain conditions it may be an advantage to use a leguminous crop along with the elephant grass. Vetches or peas, for example, could be planted between the rows in the winter and perhaps cow peas could be used in the summer.

CONCLUSION

Elephant grass is a hardy perennial, well suited to the Western Australian climate. If managed correctly it yields a heavy annual crop of palatable nutritious herbage. Because of its high productivity elephant grass requires a good well drained soil with ample nitrogen-rich fertiliser. Regular cutting or well controlled grazing is essential if protein-rich herbage is desired.

Acknowledgment.—The analyses of the fodder samples grown at the Animal Health Laboratory were carried out by the Government Chemical Laboratories, and the authors wish to express their appreciation of the co-operation given in this work.

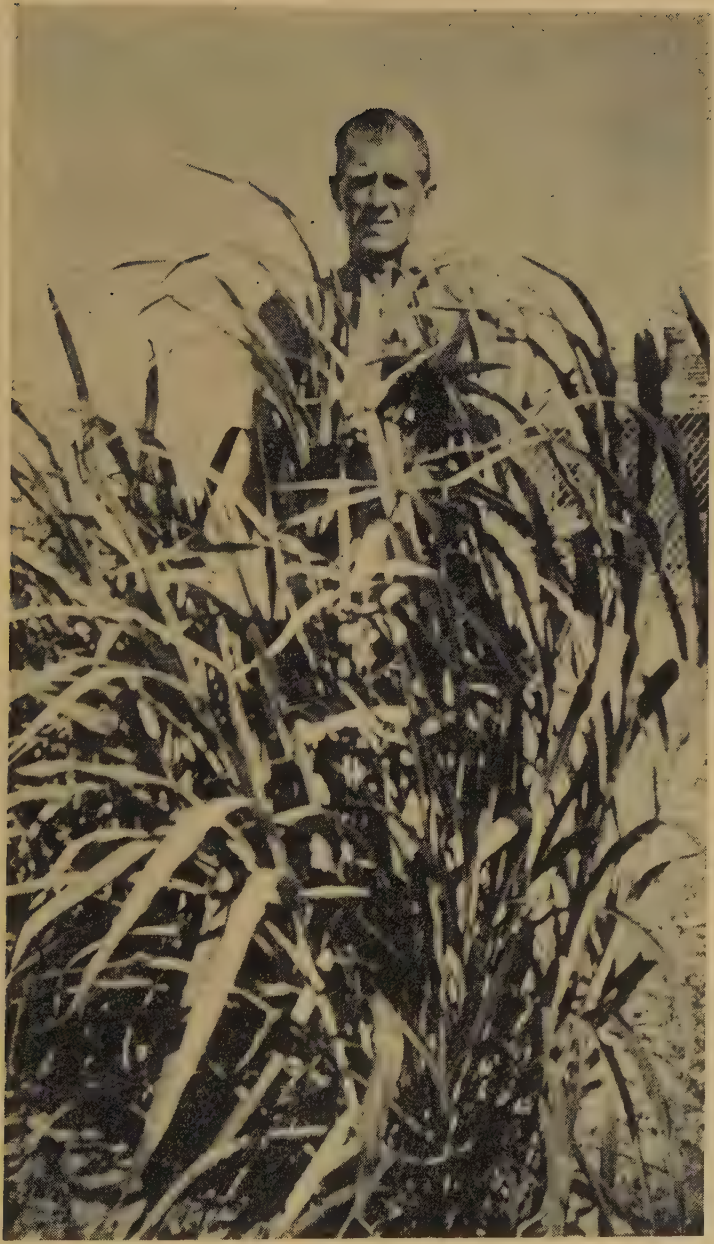

Fig. 4.—Even on poor sandy soil elephant grass makes rapid growth. This plant had been cut to ground level five weeks previously.

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FOWL POX

Could you please advise me how to cure a disease which has affected many birds in my flock of pullets during the past two weeks? The birds were hatched in July last and commenced laying three months ago in December when they were 5½ months of age. They reached a 60 per cent. lay three weeks ago and I thought I was set for a good season but now their production has dropped to a 30 per cent. level, presumably as a result of this disease. Several birds have died and many more are looking very sick with swollen eyes and running nostrils. Some of the birds seem to breathe through their mouths and others, although they look healthy, have scabs on their combs. Second season birds in the adjoining pen are not affected.

From the information given it is clear that your pullets are suffering from "fowl pox," a virus disease which is prevalent throughout the State and which causes much financial loss to poultry keepers each year, particularly during the autumn months.

Many of the more successful poultry farmers make a practice of vaccinating each season's chickens against the disease when they are 12 weeks of age.

The vaccination is a simple operation which is performed on the thigh of the bird. Once vaccinated, the bird is given a life-long immunity to the disease. Directions given in the leaflet which I have forwarded under separate cover outline the method of vaccination and further particulars are provided with each carton of vaccine. The vaccine, together with an applicator (a small needle) can be obtained from any Perth firm which stocks poultry requisites. Ten days after the vaccination has been carried out about 10 per cent. of the birds should be examined for "takes" at the point of vaccination on the thigh. A small swelling with usually a scab at the top indicates that the vaccination has been successful.

The old adage that "Prevention is Better than Cure" applies particularly to fowl pox, a disease which can be so devastating in its effect yet can be easily prevented by vaccination.

The information given so far has not assisted you in any way to overcome your present problem but the importance of vaccination is stressed as it is the only satisfactory means of combating this disease. It is recommended therefore, that you give serious thought to the vaccination of all chickens which you purchase in future years.

In the meantime it is suggested that you isolate the sick birds and dab tincture of iodine on the scabs on the comb, face and wattles. Two applications should be sufficient. As a result of this treatment the scabs will dry up and fall off. The formation of these scabs on the face parts is usually the forerunner of swollen eyes and yellow cankerous material in the mouth and throat. If the scabs are treated with tincture of iodine in the early stages, the disease can sometimes be prevented from spreading to the eyes and mouth.

The difficult breathing to which you refer is no doubt caused by the presence of cankerous material down the throat and over the opening to the windpipe. This material should be removed with the aid of a hairpin or a sharpened piece of softwood and the area painted with tincture of iodine. This can be conveniently carried out by pulling a flight feather from the wing, dipping the tip of the feather into the iodine, flicking off any surplus iodine which might adhere to the feather and then painting the affected area with the iodine remaining on the feather.

Birds which are blinded should be destroyed and the remainder with eyes only slightly affected should have them treated with a 10 per cent. solution of argyrol. One drop of argyrol should be placed in each eye daily.

Birds suffering from a Vitamin A deficiency are pre-disposed to attacks by fowl pox. Also birds provided with adequate Vitamin A in their diet are likely to give a quicker response to the treatment outlined above. Should the green feed be of poor quality or be difficult to obtain, you are advised to commence feeding one of the proprietary feeding supplements rich in Vitamin A, immediately. These supplements include Vita-Oil A, Vetemul (blue label) or Ovadol. Continue feeding the supplement at the strength recommended by the manufacturer until such time as the green feed becomes adequate from the point of view of both quality and quantity.

That the second year birds are not affected is explained by the fact that having had the disease, a bird develops a life-long immunity to it and it is possible that your second year hens were affected with the disease in a mild form last year, so mild a form perhaps that it escaped your notice, and carrier birds have passed the disease on to your pullets. Many poultry diseases are transmitted in this way and birds of widely different ages should never be housed in adjacent pens.

The disease can be carried long distances and can be transmitted from one bird to another by mosquitoes so that isolation of a poultry farm does not eliminate the necessity to vaccinate each year's chickens against this disease.

This outbreak of disease will probably prove very costly as poultry do not require very much encouragement to moult during the autumn months and consequently many of your birds can be expected to moult and cease producing eggs for 2½ to 3 months. The production has already fallen from a 60 per cent. to a 30 per cent. level and it will probably fall even lower.

CATTLE RAISING IN THE KIMBERLEYS

Would there be any chance for a man with moderate capital to establish himself in the cattle business in the Kimberleys? I would be able to maintain myself and a small staff for a year or two in the initial stages and would have £2,000 or more for the purchase of stock.

There is not much opportunity at present for an individual of comparatively small means to enter the cattle-raising industry in the Kimberleys. Practically all suitable cattle-raising country is held under lease in very large areas. The average station would be about one million acres in extent and the leases do not expire until 1982. Stocking rates under the present range conditions would be something in the order of one beast per 100 acres.

Possibly the industry will be so organised in future years that there will be scope for smaller holdings on which cattle, bred on the larger stations, might be fattened prior to delivery to the meatworks. However, there is no such land available at the present time and we cannot offer much encouragement to intending settlers in that area as yet.

There may, of course, be opportunities for an individual who knows the country and the industry to select a small area and make local arrangements with the present lessee. Even then, however, a fencing programme would present enormous difficulties in these areas.

RICE-GROWING

Could you please supply any information on the growing of rice? Have you a research station in the northern section of this State which has grown rice successfully? Is there any suitable land available that could be cleared and irrigated at moderate cost, also would the rainfall in the Kimberley area be heavy enough to grow rice without irrigation?

Cultural operations in rice growing are very similar to those employed for growing wheat, with the exception that the land must be held in a flooded condition for the greater part of the growing period. The Department of Agriculture of New South Wales could supply leaflets concerning rice cultivation should you ever get to the stage of planting a crop.

Rice is being grown on the Kimberley Research Station situated on the Ord River about 50 miles from Wyndham. Early crops have been commercial failures because the varieties available in Australia have been unsuitable for the district. We recently obtained about 250 varieties from overseas sources, however, and of these approximately 12 varieties have shown sufficient promise to warrant further research. They are now being grown in accumulation plots and in a series of trials designed to enable us to select the varieties most likely to succeed under Kimberley conditions. It is unlikely that we will have sufficient information to discuss the possibilities of commercial rice growing until another two or three seasons have passed.

Owing to the sharp division of the Kimberley weather into the dry and wet seasons, rice-growing without irrigation is hardly likely to be successful except perhaps in a few selected areas.

A company is preparing to sow rice in the Fitzroy River district about 80 miles from Derby. These crops will be irrigated by pumping from a billabong filled by the Fitzroy River.

BEEHIVE REGISTRATION

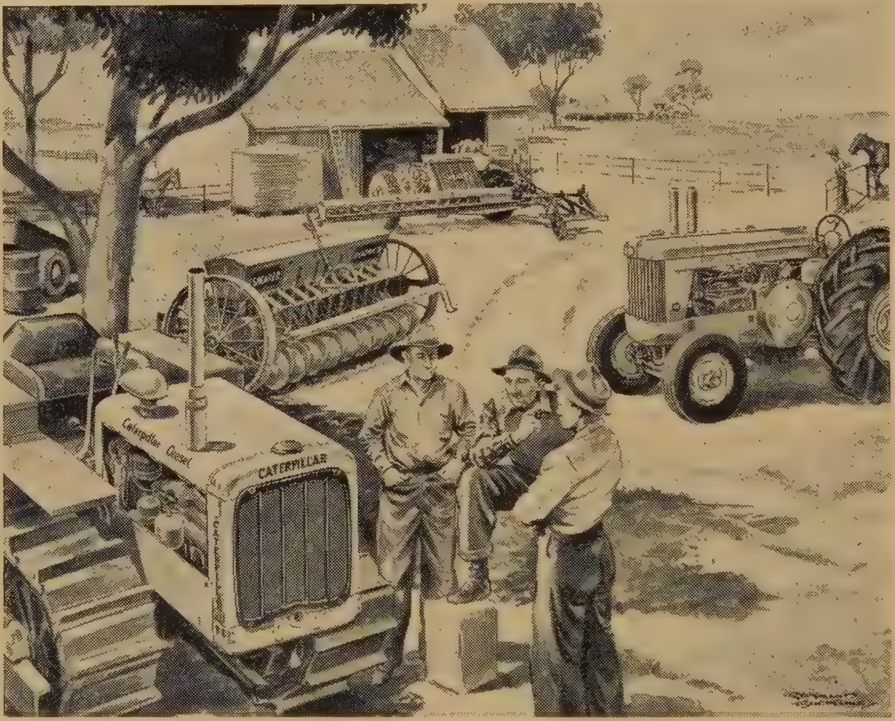
I intend to obtain a few hives of bees this season and am informed that I must pay a registration fee. What is the amount of the fee and what is the procedure for registration?

Write to the Government Apiculturist, Department of Agriculture, Adelaide Terrace, Perth, and obtain an application form for registration as a beekeeper. Fill in the form and return it with the sum of 10s.

This covers the annual registration fee of 2s. 6d. for up to 25 hives, plus 7s. 6d. for the registration of your hive brand. The 2s. 6d. is an annual charge due on December 31 of each year, but the brand registration does not require renewal.

Amendments to the Bees Act make it obligatory for a beekeeper to brand his hives and equipment. Full details of the Bees Act are given in Leaflet No. 1046 which may be obtained free of charge on application to the Department of Agriculture.

WARNING.—A number of beekeepers have not registered their hives and are liable to be prosecuted for non-compliance with the Bees Act. They are urged to complete their registration forms immediately.



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SALT TOLERANT PLANTS

I would be grateful if you could give me a list of salt-tolerant flowers, fruit trees, vegetables and shrubs. The last report on the water gave the salt content as 150 grains to the gallon.

Excessive salt in the soil or water has, generally speaking, a greater effect on annual species than on perennials. For that reason it would be wiser to plant shrubs and longlived flower species rather than attempt to work the soil to bring it into a suitable condition for the growth of annual plants. A certain amount of preparation will be necessary, however, before trees could be planted successfully.

The number of salt-tolerant species is not great but we would recommend the following trees:—Salt River gum *(Eucalyptus sargenti)*; York-gum *(Eucalyptus loxophleba)*; sheoak *(Casuarina lepidophloia and glauca)*; tamarix *(Tamarix gallica)* and date palms.

Most of these trees may be obtained from the Forests Department nursery, Hamel. Other species that are tolerant of salt are the variegated bamboo *(Arundo donax)* and the numerous cultivated species of mesembryanthemum.

Fruit trees are not very tolerant of saline conditions, particularly citrus, grapevines and some of the stone fruits. The figure you quote for salt content of water is somewhat high for the satisfactory growth of fruit trees especially if the salt content of the soil is also high. If this is not the case, then systematic heavy waterings plus good drainage may enable some success to be achieved.

It is suggested that the most practical solution to your problem would be to try to grow fruits which mature early in the summer such as early peaches. These may be able to survive because their growing period ends before the onset of the driest conditions. Winter rains would tend to wash excess salt below the root zone and the maximum salinity would not occur until the trees had completed their seasonal growth.

Vegetables.—Root types such as beetroot and mangolds are very salt-tolerant. Others which are fairly tolerant are cucumbers, melons and pumpkins, cabbages, cauliflowers, rhubarb, celery, asparagus and silver beet. Leaflet number 1009 which may be obtained free of charge from the Department of Agriculture, St. George's Terrace, Perth, gives further details of salt-tolerant plants.

BLOWFLY STRIKE

I am managing a property which in 1949 lost very large numbers of sheep through blowfly strike and although the losses were less severe last year I would be grateful for information concerning the Mules operation and other advice concerning any preparation which would protect sheep from fly strike or is suitable for the treatment of struck sheep.

A leaflet describing the Mules operation has been posted to you, and it is suggested that this work should be the basis of your campaign against the blowfly. The tailing of lambs at the recommended length, i.e., at the level of the vulva and the arrangement where possible of crutching and annual shearing to take place just in advance of the periods when waves of fly strikes are anticipated would be other suitable measures to adopt.

There are no blowfly dressings which can be confidently relied upon to protect sheep from fly strike for any length of time, but for the treatment of struck sheep dressings containing boric acid such as "B.K.B." may be recommended. Dressings of this type, besides destroying the maggots and promoting healing will usually prevent re-strike over a period long enough to enable the original wound to heal.

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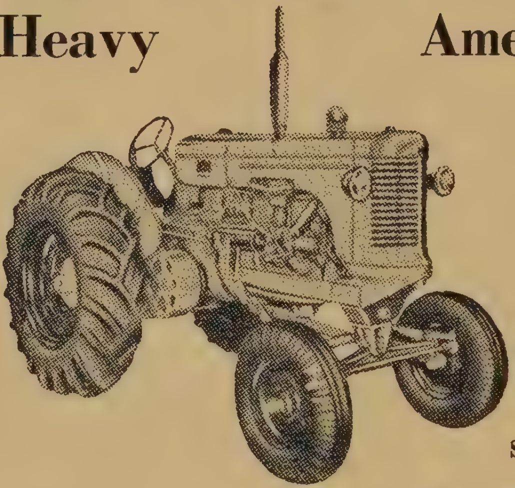

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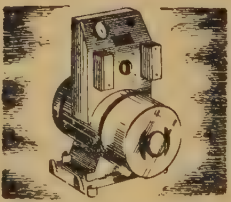

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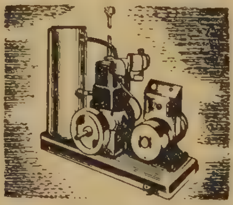

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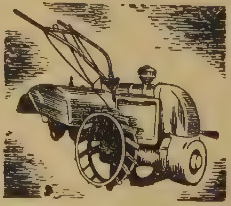

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"SWELLED HEAD" IN RAMS

By C. R. TOOP, B.V.Sc., Chief Veterinary Surgeon

DURING the summer and autumn months a disease of rams, popularly known as "swelled head" or "big-head" is encountered from time to time in Western Australian flocks. The condition is almost entirely confined to rams of the horned breeds and outbreaks which have come under notice in this State have occurred only among Merinos and Dorset Horns. Young rams and weaners are most frequently affected and the disease results from the infection of wounds about the forehead sustained by the animals when fighting.

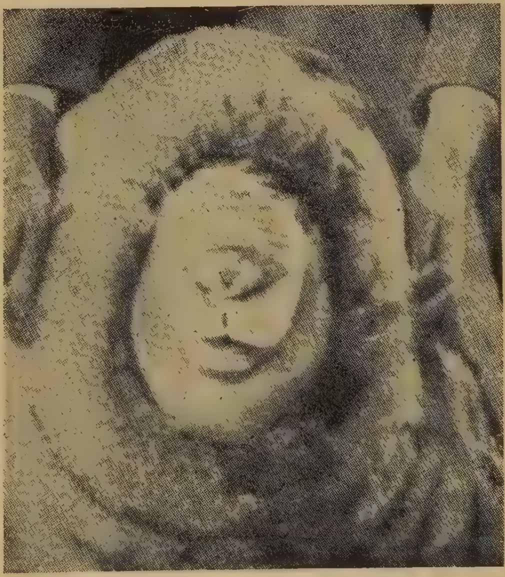
Rams of all ages may become affected but the disease is seen most frequently in weaners which appear to be less resistant to infection than are older rams. Moreover, weaners are usually allowed to run in fairly large mobs and at this age are more prone to indulge in fighting than are the more mature animals.

SYMPTOMS

The disease gains its popular names from the main symptom, a dropsical swelling of the head which in consequence becomes enormously enlarged. The outward indications of the disease usually commence with a slight swelling beneath the lower jaw which rapidly increases in size until, at the end of 24 hours, the head may be distended to twice its normal size, The swelling involves the lower jaw, throat, nose, face, eyelids and ears and may in some cases extend to the upper portion of the neck.

At this stage the animal is unable to eat or drink and spends most of its time lying down in the normal resting position. As a result of the swelling, the eyelids are completely closed and a discharge containing pus is usually observed. The eyes are normal in appearance, however, when examined by parting the lids. The breathing rate is increased and in some cases is accompanied by snoring. In the majority of cases, death occurs within two or three days of the onset of symptoms unless treatment is given, but spontaneous recovery may occur in less severe cases.

Although the percentage of rams which become affected is usually small, rarely exceeding five per cent. of the flock, the disease may become a matter of serious concern particularly to the studbreeder on account of the high value of individual animals which may succumb to the disease.



"Swelled head" in a young Merino ram.
(After Bull.)

POST MORTEM APPEARANCES

On opening the swelling, the tissues immediately beneath the skin are seen to be infiltrated with a clear straw-coloured fluid which exudes freely from the cut surface and coagulates to form a gelatinous mass on coming into contact with the air. The deeper muscular tissue is normal in appearance. The thorax or chest cavity contains a large quantity of the same straw-coloured fluid. The pericardial sac which encloses the heart, also contains an excess of fluid but no other changes of note are observed at post mortem.

CAUSE

The disease is caused by a micro-organism known as *Clostridium oedematiens,* which is widely distributed in nature and is frequently found in the soil of farm lands. These organisms gain entrance to wounds in the region of the forehead and bases of the horns where they become established and multiply, setting up the characteristic changes in the tissues already described. The wounds are often quite small and insignificant and their presence may be overlooked unless a careful examination is made.

Mortalities in rams resulting from "swelled-head" appear to be confined to the dry period of the year, occurring particularly during the autumn months. Outbreaks of the disease have not been observed during winter or spring when the soil is moist and covered by a good growth of green herbage. This rather suggests that the infection of the wounds results from the contamination by dust containing spores of the casual organism.

DIAGNOSIS

The fact that the disease is confined to rams and more particularly young rams, will usually serve to distinguish "swelled-head" from other diseases. Light sensitization is probably the only condition with which it is likely to become confused.

Light sensitization may be induced by the consumption of a variety of plants which under certain conditions form a substance in the blood which sensitizes the body cells to the sunlight, resulting in the formation of oedematous (containing a watery fluid) swellings in the skin and underlying tissues.

Sheep suffering from light sensitization may show considerable swelling of the head, but this is accompained by dermatitis or inflammation of the skin, which may cause considerable irritation. Vesicles and pustules which subsequently rupture and discharge make their appearance on the affected skin, which in consequence becomes covered with crusts and scabs. In severe cases sloughing of the superficial layers of the skin may occur. The condition may also affect the lower portions of the limbs, and the backs of newly shorn sheep.

In contrast with "swelled-head," which is largely confined to young rams, light sensitization may affect sheep of both sexes and all ages. Moreover, when affected sheep are removed from the offending pasture and placed under cover out of the direct rays of the sun, recovery usually occurs. Cases of "swelled-head" rarely recover without special treatment.

PREVENTION BY VACCINATION

Vaccination provides the only practical and reliable method of prevention. Black disease vaccine prepared from cultures of the organism which cause the disease is used for this purpose.

The dose of this product for the sheep is 2cc. which should be injected beneath the skin of the bare area on the outer surface of the brisket. A single injection of the vaccine confers a strong and lasting immunity which may be relied upon to protect the animal from infection for at least one year after vaccination.

A very high degree of immunity is developed 14 days after the injection, the maximum being reached at about 21 days.

On properties on which the disease is known to occur, rams should be vaccinated at the beginning of summer, which will provide them with adequate protection during the ensuing 3-4 months when they are exposed to the greatest degree of risk. Ram lambs could, if found convenient, be inoculated at the time of weaning.

In passing it is interesting to note that the same organism *(Cl. oedematiens)* which causes swelled head in rams also causes "black disease"—a braxy-like disease, which is responsible for serious mortalities in sheep in Eastern Australia. "Black disease," however, occurs only in association with infestation by the liver fluke. Fortunately the liver fluke does not occur in Western Australia, which in consequence is also free of "black disease." The same vaccine protects against both diseases.

TREATMENT

For the treatment of affected rams the injection of gas-gangrene antiserum *(oedematiens)* in a dosage of 5,000-10,000 units may be recommended. Provided treatment is commenced early enough, a satisfactory response may be expected.

This product is prepared by the Commonwealth Serum Laboratories and is available from the Commonwealth Department of Health, Fourth Floor, G.P.O., Perth. It is administered by injection beneath the skin of the brisket by means of a hypodermic syringe.

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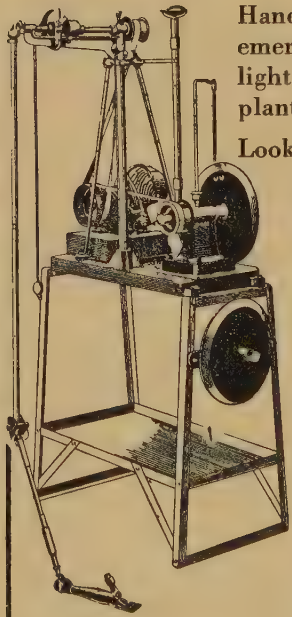

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STRAIN 19 IN WESTERN AUSTRALIA

Its Success in the Control of Brucellosis

CONTRIBUTED BY THE VETERINARY BRANCH

SINCE the inauguration of its brucellosis control campaign in 1946, the West Australian Department of Agriculture has inoculated nearly 72,000 dairy heifers with Strain 19 vaccine and established a remarkable degree of control throughout the dairying districts. As the success of the control measures is largely dependent upon the vaccination of each year's crop of heifers, the work is now being intensified and members of the field staff are again busy in the dairying areas.

Brucellosis, or contagious abortion as it is commonly called, is widely distributed throughout most of the world's dairying areas and this State is no exception to the general rule. As a source of loss to the dairying industry the disease is second only in importance to mastitis. It is responsible for the loss of large numbers of calves every year and also for considerable reduction in milk yields. In addition, sterility resulting from metritis or inflammation of the uterus (womb) frequently occurs as a sequel to the disease.

DESCRIPTION

Brucellosis results from infection of the pregnant uterus with a micro-organism known as Brucella abortus which sets up an inflammation causing the death and premature expulsion of the calf. The majority of such abortions occurs between the fifth and seventh months but the calf may be lost as early as the third or as late as the eighth month of pregnancy.

The disease is spread by the fluids which are discharged at the time the calf is lost, by the aborted calf and afterbirth, and by the discharges passed out by infected cows for several weeks after abortion and sometimes after normal calving. Such substances contain enormous numbers of the Brucella organisms which contaminate the pastures and are liable to be ingested by other cattle while grazing, thus spreading the infection.

In the past, so called "abortion storms" were fairly common. They were usually caused by the introduction of infected heifers or cows, purchased as replacements, into clean herds which, owing to their isolation or good fortune, had not previously been exposed to infection and were consequently highly susceptible.

When brucellosis is introduced into a susceptible herd it frequently runs an acute course during which a large number of abortions may take place in rapid succession, but after a season or two it gradually subsides and a stage is reached where few abortions occur and these are largely confined to heifers and young cows.

As the result of continued exposure to infection, the majority of the older cows in the herd eventually develop a

Cattle being inoculated with Strain 19 vaccine at an inoculation centre near Donnybrook.
—Photo by courtesy of the South-Western Times, Bunbury.

natural immunity or resistance to the disease which enables them to carry their calves to full term. They may, however, remain carriers and continue to spread infection. Heifers which have not previously been exposed to infection are highly susceptible unless protected by inoculation with Strain 19 vaccine, and the abortion rate in these animals may be very high.

BRUCELLOSIS AND PUBLIC HEALTH

Apart from the economic losses caused by the presence of brucellosis in dairy herds, the disease has an important bearing on human health. The infection is transmissible to man causing the disease known as undulant fever which may be contracted by consuming milk from infected cows.

Horses are also susceptible to infection with Brucella abortus and the organisms are often found in the abscesses which form in such conditions as fistulous withers and poll evil. These are large swellings which develop in the region of the withers and poll, and which finally rupture and discharge pus for prolonged periods. Conversely, horses suffering from fistulous withers could be responsible for brucellosis infection in cattle if allowed to run in the same paddocks.

CONTROL MEASURES

Like many other diseases affecting livestock, brucellosis may be controlled by vaccination. For this purpose a live vaccine, prepared from a strain of Brucella abortus of low virulence, is employed. This product is known as Strain 19 vaccine.

When injected into heifers it does not cause permanent infection or subsequent abortions and it cannot be transmitted from one animal to another. It does, however, stimulate the formation of antibodies in the blood and tissues of the vaccinated animal, confering upon it an immunity or protection which enables it to resist infection if subsequently exposed.

Although this immunity is not absolute and may be broken by exposure to a massive infection, it is of a high order and is usually sufficient to protect the animal for at least three pregnancies if not for life.

Many extensive tests have been carried out in the U.S.A. and in other dairying countries throughout the world and in every case the use of Strain 19 has been followed by a sensational drop in the abortion rate.

THE TEST AND SLAUGHTER METHOD

In some countries attempts were made to control the disease by subjecting all cattle above the age of six months to a blood test known as the agglutination test. Any which gave a positive reaction to this test were removed from the herd and slaughtered. Testing was repeated at intervals of 30 days until all the animals in the herd showed negative reactions on two consecutive occasions. Thereafter the herd was declared brucellosis-free and subjected only to annual tests.

In the U.S.A. the test and slaughter method has been successfully employed but at enormous cost. The scheme is still operating in some American States in conjunction with Strain 19 vaccination.

While the advantages to be derived from the complete eradication of the disease are obvious, being reflected in an increase in the number of calves produced, greater breeding efficiency and increased milk production, the test and slaughter method is a very costly procedure and there are few countries in which it could be adopted as a general method of control. In Western Australia where the disease is widely distributed throughout the dairying districts and where the incidence of infection in many herds was high, the test and slaughter method was neither practical nor economically possible.

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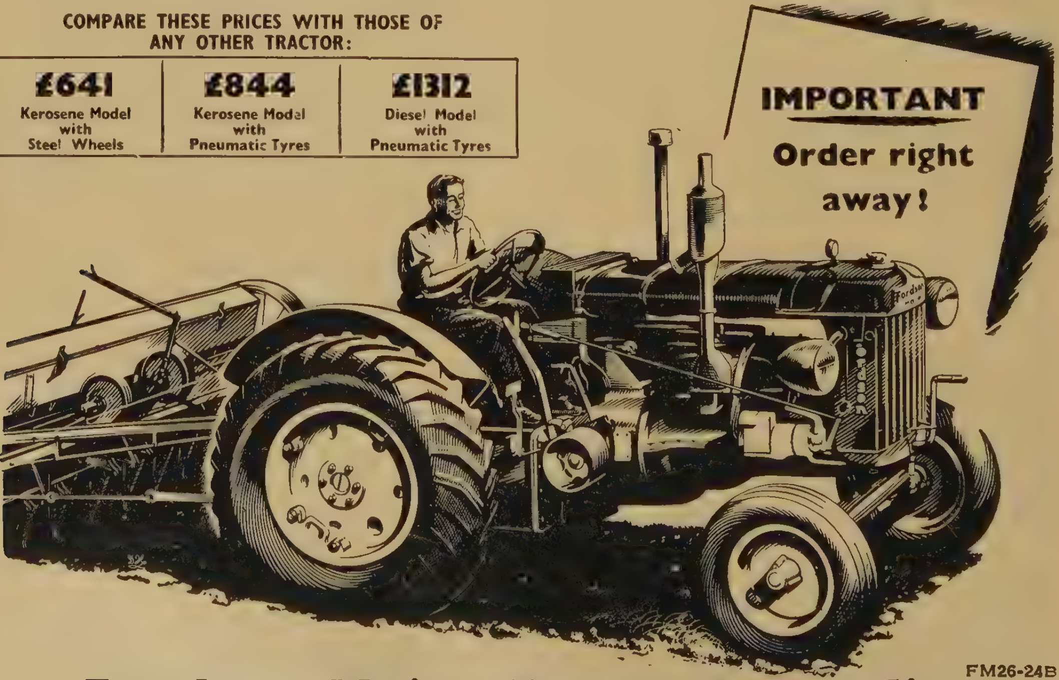

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VACCINATE THE HEIFERS

Vaccination by Strain 19 offers a practical method of control and its greatest advantages would be obtained when each year's crop of young heifers are vaccinated, preferably between the ages of nine and twelve months.

The vaccination of heifers is recommended both in clean and infected herds. The advantages to be obtained in the case of the infected herd are obvious and need not be emphasised. In the clean herd the procedure is equally sound and the vaccinated animals would be in a condition to resist the disease should infection be inadvertently introduced. The use of Strain 19 in a clean herd cannot result in the introduction of the disease and the fears which are sometimes expressed by stock-owners in this connection are groundless.

Whatever method of control is adopted it is important that hygienic precautions should continue to be taken. Any cows which are bought should be isolated until they cease to discharge and the aborted foetus should be destroyed by burning or should be buried deeply.

ARRANGEMENTS FOR VACCINATION

The Department of Agriculture undertakes the vaccination of heifers throughout the dairying areas and is prepared to make officers available to carry out this work. A fee of 2s. a head is charged for all cattle treated in order to defray the cost of the vaccine, and the ear-tags used for identification purposes. In order that the scheme will be successful, the fullest co-operation on the part of dairy farmers is necessary and it is requested that, wherever possible, vaccination centres should be established to which heifers from surrounding properties can be brought for vaccination.

The provision of a well-constructed crush will greatly facilitate the work of Department officers and will considerably increase the number of heifers it will be possible to vaccinate within a stated period. A crush from 15 to 30 feet long, four feet six inches high, and 20 inches wide with a forcing-pen at the entrance and an exit gate for the release of cattle after treatment will meet requirements. The rails should be about eight inches apart and, whatever type of crush is employed, it should be strongly constructed in order that the cattle may be adequately restrained during treatment.

In most dairying districts the local branches of the Farmers' Union have undertaken to make arrangements for the vaccination of heifers in their areas. They usually acquaint the officers of the Department of Agriculture with the numbers of heifers to be treated and co-ordinate the arrangements for grouping them in some central spot for treatment.

EFFECTS OF VACCINATION

Following vaccination, a swelling develops at the site of the inoculation. This gradually subsides but a period of several months may elapse before it finally disappears. The animal may become rather tucked-up in appearance for a few days and there is often a falling-off in appetite. In the case of cows, there is usually a sharp decline in milk yield which sets in within 48 hours of vaccination and persists for about a week before a return to full production occurs.

Cattle vaccinated with Strain 19 develop a positive reaction to the agglutination test which cannot be differentiated from the reaction resulting from a natural infection. In the case of calves, these reactions subside fairly rapidly and all but about five per cent. of them become negative within 12 months. In adult cattle, however, the reaction persists for a much longer period. Under our conditions, the persistence of a positive blood reaction is only likely to be of importance in the case of cattle which are intended for export to other States and countries and are required to be accompanied by a negative agglutination test certificate.

Further particulars concerning brucellosis and Strain 19 are available in Leaflets Nos. 832 and 875 which are available free from the Department of Agriculture.

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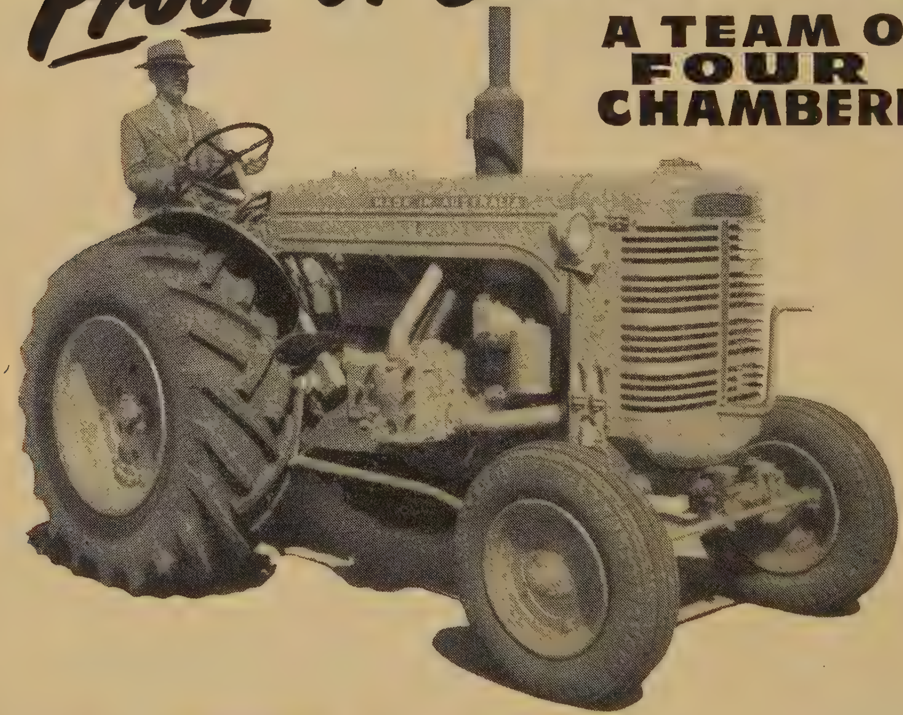

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INSECT Pests AND THEIR CONTROL

by C. F. H. JENKINS, M.A. (Government Entomologist).

THE WEBWORM

(Talis pedionoma Mayr.)?

E.M.N.

By C. F. H. JENKINS, M.A., Government Entomologist, and P. N. FORTE, B.Sc. (Agric.), Senior Entomologist.

THE popular name webworm has been applied to a small caterpillar whose depredations in ploughed-in wheat crops have concerned farmers in this State for many years. The first record of the insect as a pest was made by Newman (1927) under the scientific name of Sclerobia tritialis Wlk. and it has been referred to as such in all subsequent Departmental publications. Recent investigations, however, suggest that either more than one species of insect is covered by the term webworm or that the true webworm is a Crambid moth known as Talis pedionoma Mayr.

The matter can be finally settled by breeding adult moths from webworm caterpillars collected in the field but so far attempts to do this have proved unsuccessful. Autumn collections of small moths inhabiting typical "webworm country" have shown a high population of *Talis pedionoma* but other closely allied moths, particularly *T. panteucha,* may also be abundant. The exact identity of the moth may seem to the farmer to be of academic interest only but in actual practice a correct determination will greatly aid in elucidating life history studies of the pest and consequently the development of control measures.

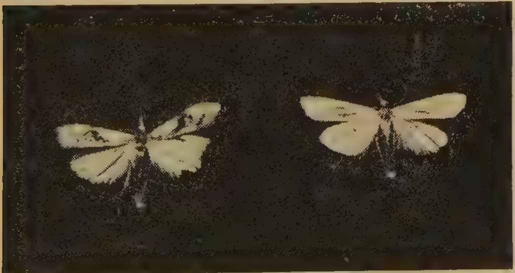


Fig. 1.—Webworm moths (natural size).

DESCRIPTION

The various species of moths which may be implicated are small greyish insects with dark stripes and markings. The wings are closely folded around the body when at rest so that the moths harmonise closely with the background of dry grass or stubble.

The fully fed caterpillar measures approximately ¾ in. in length and is dark greenish-black in colour. Caterpillars may be found on the surface of the ground at night but spend the day hidden in vertical silk-lined tunnels in the soil. It is the silken webbing in these tunnels which has been responsible for the popular name of the insect.

LIFE HISTORY

Many life history details still require investigation, but the adult moths fly in the early autumn and show a preference for old grass paddocks as egg-laying sites. Barley grass flats are particularly favoured. Caterpillars feed during the winter and apparently restrict their diet to grasses and cereals as opposed to broad-leafed weeds and clover.

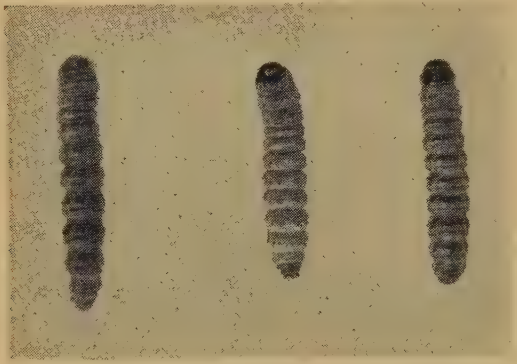


Fig. 2.—Webworm caterpillars (enlarged).

When fully fed and with the arrival of warm dry conditions in the spring the caterpillars deepen their burrows and enter a quiescent stage. The exact period at which pupation occurs is not yet known, but this may be shortly before moth emergence in the autumn.

ECONOMIC IMPORTANCE

The importance of the webworm as a pest has increased in recent years owing to the reduction in fallow cropping in many areas. Clean fallow paddocks are not attractive to egg-laying moths and so crops planted on good fallow are never injured. However, where grass paddocks are turned-in and planted to wheat shortly afterwards serious losses may occur.

Webworm damage in wheat crops first manifests itself by the appearance of thin patches in the young crop. These patches may later become completely bare and extend in size to join up with adjacent patches. A superficial inspection of the area may fail to reveal the presence of caterpillars, as these will be hidden in the daytime in their subterranean tunnels. A search amongst the clods around the edges of a bare patch, however, will usually disclose some caterpillars. The small entrance holes to the tunnels, sometimes with a half-eaten blade of wheat protruding, are also characteristic signs to the more experienced observer.

In addition to the damage caused to cereal crops, less conspicuous but very serious losses may also occur in feed paddocks where the caterpillars destroy or adversely affect the growth of various grasses. The full extent of the damage may be masked by clover, capeweed or other plants but the depletion of true grasses in the pasture may be quite serious. Some idea of what injury could be caused will be gained from the fact that population samples have revealed approximately half a million caterpillars to the acre in some grass paddocks.

SUSCEPTIBLE PLANTS

Amongst the commonly grown cereal crops wheat, barley and rye are liable to webworm attack. Oats, on the other

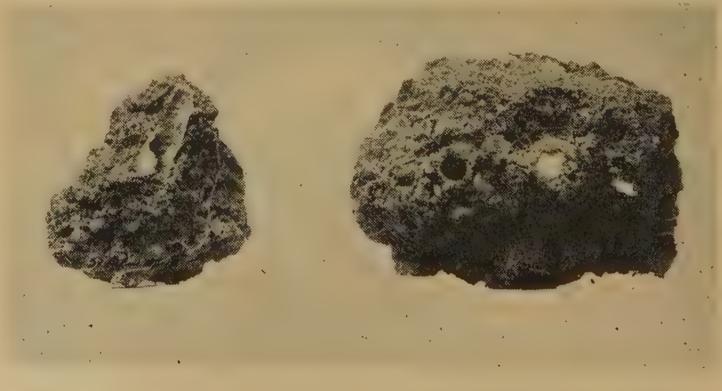


Fig. 3.—Left: Webworm tunnel broken open. Right: Two empty tunnels and (centre) an over-summering tunnel closed by webbing.

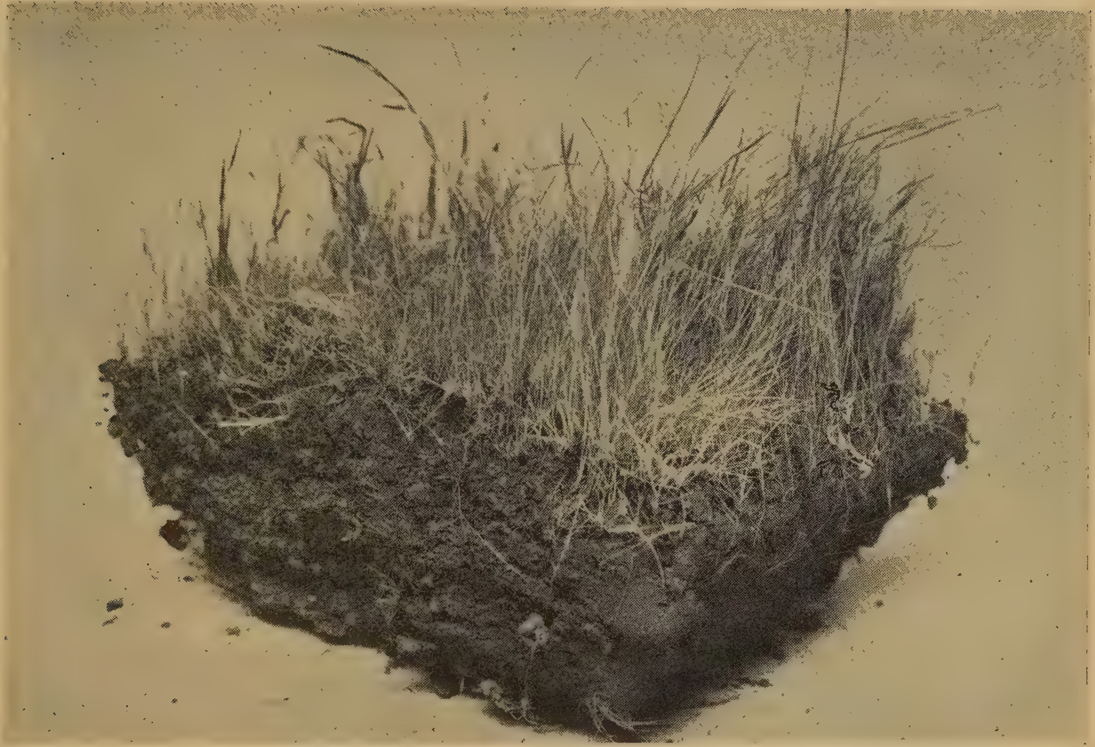


Fig. 4.—Sod sample taken from dry grass paddock infested with webworm.

hand, appear to be quite immune as numerous observations have been made where wheat has been totally destroyed by webworm and oats in the next drill row have been untouched. In mixed grass and clover pastures clover appears to be entirely ignored but detailed information is not available as to just which type of grasses are preferred, with the exception of barley grass *(Hordeum murinum)* which seems to be first favourite.

CONTROL MEASURES

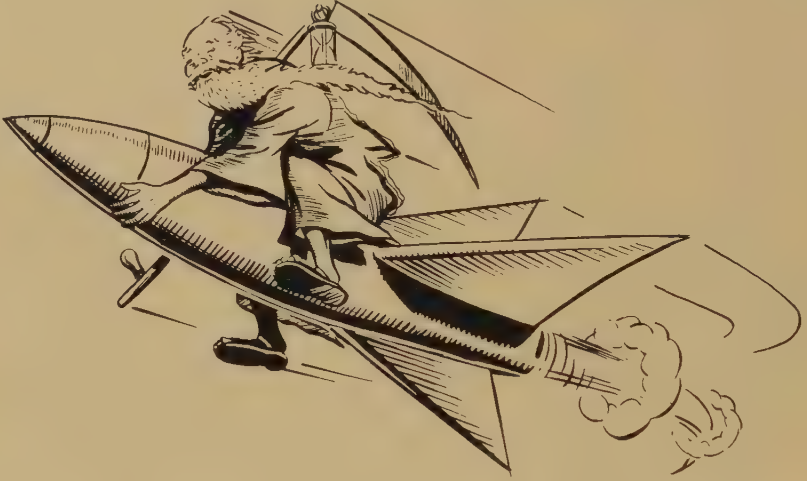
Cultural Operations

Various investigations have been carried out by officers of the Entomological Branch in co-operation with members of the Wheat Branch and individual farmers in order to test out the effect of cultural operations on the incidence of webworm. These investigations have not been concluded but a brief summary will be given of the progress made to date.

The results achieved by various cultural methods may, of course, be expected to vary with seasonal conditions and perhaps from district to district. The practicability of certain recommendations will also vary considerably in accordance with local differences in rainfall and soil type.

Fallow

The surest known method of preventing webworm losses on susceptible cereal crops is to plant on clean fallow. For reasons of soil conservation and the greater use of land for stock grazing, there has been a considerable reduction in fallowing operations in recent years and a consequent increase in conditions favourable to webworm activity.



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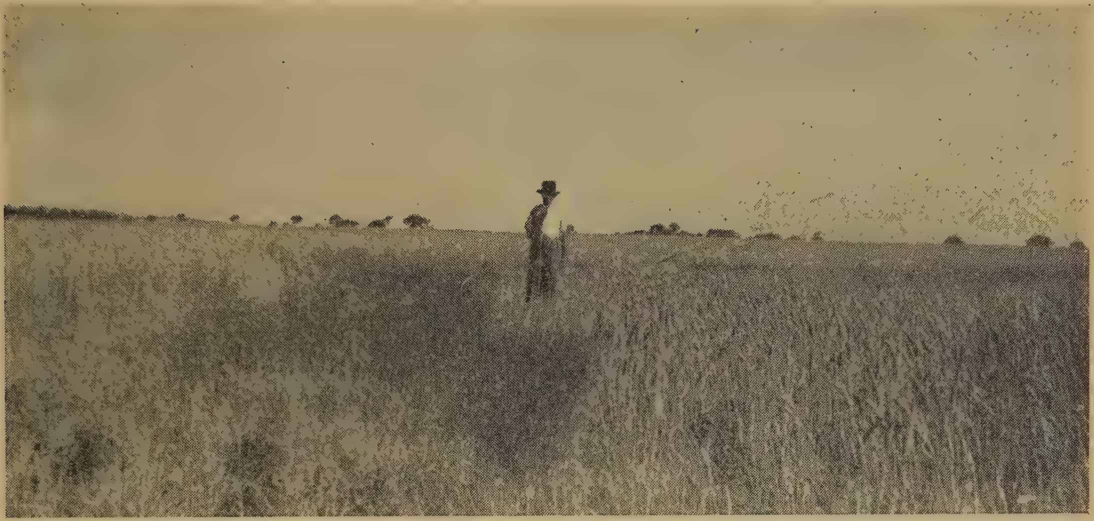

Fig. 5.—Effect of D.D.T. on webworm activity. The strip in the left foreground was untreated. It is covered with weeds and almost devoid of wheat plants. On the right is the plot dusted with D.D.T. showing high rate of survival of treated wheat plants.

Time of Planting

In order to test the effect of time of planting upon webworm activity a series of trials were planted using wheat as the susceptible crop and oat buffers to prevent migration from one treatment to the other. Without giving details of trials, their results indicate that early sown crops are less liable to webworm injury than late ploughed-in crops and that where sowing can be delayed a fortnight or three weeks after ploughing the likelihood of webworm loss will also be reduced.

Rolling, Harrowing and Replanting

Webworm outbreaks are often so patchy and the rate of spread so uncertain that although further extension may cease following harrowing or cultivating, the restricted activity is often associated with the natural habits of the creature rather than any direct effect of the implements used.

Observations on webworm infested areas which were rolled, harrowed or cultivated did not indicate that any appreciable control can be obtained by such methods. Replanting with wheat in most cases proved successful, although a few farmers have reported adversely on this practice.

Chemical Control

The control of pasture and cereal pests with chemicals is often an uneconomic proposition, not only because of the price of chemicals but because of the large areas involved and the difficulties and cost of application.

Because of its outstanding effectiveness against many other caterpillar pests however, it was decided to try D.D.T. on a field scale against the webworm. Preliminary tests were made in 1949 and the first field treatments were applied on wheat crops at York and Goomalling in July, 1950. The rate of application was 28 lb. of 2 per cent. D.D.T. dust per acre and this produced a heavy caterpillar mortality.

During the 1951 season D.D.T. from 4 ounces to 2 lb. per acre was tried on natural grass pasture. The insecticide

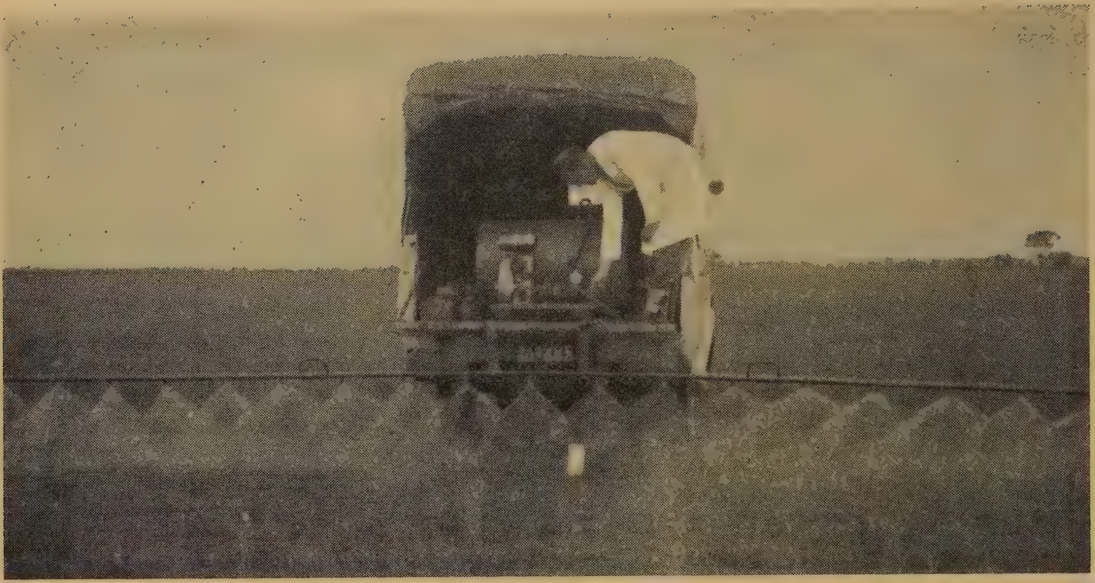

Fig. 6.—Applying insecticides by means of a low-volume spraying boom.

was applied as a spray through a low volume spray boom at the rate of 10 gallons per acre.

Sampling prior to treatment revealed a caterpillar population of approximately half a million to the acre, and all treatments almost entirely eliminated the caterpillars from the sprayed areas.

NEED FOR FURTHER INVESTIGATIONS

A detailed knowledge of the insect's life history is essential so that more accurate recommendations based upon ploughing and sowing dates may be deduced. D.D.T. and superphosphate mixtures applied as a topdressing require careful study and the possible use of several new insecticides are worthy of trial.

Further experimental work is necessary to determine the practicability of using D.D.T. for webworm control on both pastures and crops. One of the chief difficulties is the scattered nature of the infestations and the varying intensity from year to year. Once bare patches have appeared in a crop then spray or dust treatments may be too late to repair the damage.

The best time to apply control measures should be immediately any thinning from webworm attack is noticed. In the case of mild infestations, however, the final losses may be unimportant even when no treatments are applied and local experience will probably guide the farmer as to whether action is worthwhile or not.

The experimental programme for the coming season has been planned with the above requirements in view, but it may be several years before some of the problems have been satisfactorily solved.

SUMMARY

(1) The exact identity of the webworm is doubtful but the insect is probably a Crambid moth *(Talis pedionoma* Mayr.)

(2) The caterpillars may cause serious damage to "ploughed-in" wheat, barley and rye crops. Oats are not subject to attack.

(3) Old barley grass paddocks appear to be most attractive to egg-laying moths.

(4) Crops planted on fallow are not subject to attack.

(5) When planting can be delayed a fortnight or more after ploughing there is evidence to show that the liability to webworm injury is reduced.

(6) D.D.T. has been shown to be very toxic to the caterpillars of the webworm moth.

(7) There is no evidence to show that rolling, and harrowing are effective controls against the pest.

(8) There is a need for more detailed information on the life history of the insect, and further insecticide trials should be made.

ACKNOWLEDGMENTS

Thanks are due to Mr. I. Common of the C.S.I.R.O. for the identification of various moth specimens. The co-operation of farmers on whose properties experiments were carried out is gratefully acknowledged, with particular reference to Messrs. J. Saddler, R. French, T. Leeson, P. W. Starr, A. F. Carter, and P. Dempster.

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TOBACCO FIELD DAY

Successful Event at Manjimup

By J. A. MALLETT

UNDAUNTED by grey clouds and misty rain, about 75 people interested in tobacco culture attended a field day at the Tobacco Research Station, Manjimup, on February 15. Fortunately the threatened downpour failed to materialise and the visitors were able to enjoy to the fullest extent an interesting and highly instructive series of demonstrations and lecturettes.

The field day, which had been arranged by Mr. T. G. Haney, the Government Tobacco Adviser, was the first to be staged on the station and it is to be hoped that it will become an annual event.

The Secretary of the West Australian Tobacco Growers' Association (Mr. J. Berry), who acted as chairman, said that he felt that such gatherings could result in marked improvements in the yields and quality of our tobacco crops as none of us was too old to learn and the talks and practical demonstrations provided ample food for thought.

He said that he was disappointed by the small number of older growers present, but the Chairman of the Land Settlement Board (Mr. G. K. Baron Hay) who addressed the gathering, said that in view of the fact that there were only 120 tobacco growers in the State he felt that Mr. Haney had no grounds for discouragement on the score of attendance.

Mr. Baron Hay said that in the past he had attended many field days in the wheatbelt where an attendance of this size would have been regarded as a highly successful gathering. Today attendances of over 1,000 visitors were common at the same field days. As the tobacco growers learnt to appreciate the practical value of the field days he felt certain that they, too, would attend in full strength.

Although he, himself, was not a tobacco grower, said Mr. Baron Hay, he was keenly interested in the progress of the industry for as Chairman of the L.S.B. he had taken a large share of the responsibility for establishing 60 new tobacco farms over a three-year period, thus practically doubling the number of growers engaged in the industry.

FIELD TRIALS

Mr. Haney showed the visitors round the trial plots on which various experimental programmes had been initiated. The first plots inspected were those on which various insecticidal treatments were being tried out. These included:—

Arsenate of lead (one part) and pollard (15 parts).

Arsenate of lead (2 oz. to 3 gallons) as a spray.

Arsenate of lead (one part); 2 per cent. D.D.T. Dust (one part) and pollard (30 parts).

Arsenate of lead (2 oz. to 3 gallons) plus 0.2 per cent. D.D.T. Emulsion applied as a spray.

2 per cent. D.D.T. Dust.

D.D.T. Emulsion (0.2 per cent.) as a spray.

Although it was yet too early to make definite recommendations, said Mr. Haney, it appeared that the preparations containing D.D.T. were the only ones giving good control of leaf miner, and in general it was found that the spray treatments were more effective than the dusts.

Another series of plots was devoted to topping trials. Some rows of plants had been topped when the flowers appeared, others when the first leaves were ripening; some were topped after the first leaves had been harvested and in other rows the plants had been left untouched. The current recommendations are that topping should be carried out after the first leaves have been harvested but careful tests are being carried out to support these recommendations.

Another trial was designed to provide basic information on the chemical composition of the leaves. Chemical analyses of "hands" of tobacco had showed wide variations in the composition of individual leaves in the hands so in this experiment each leaf was tagged and numbered for individual analysis.

Other plots were being used to test an American chemical treatment designed to prevent suckering after topping. Careful tests were being made to ascertain whether the treatment had any effect on leaf quality. The Americans say that it does not affect the quality and the chemical treatment is becoming standard practice in the U.S.A. They use a topping instrument which automatically applies a measured quantity of the chemical solution as the topping operation is being performed and Mr. Haney said that a similar instrument had been evolved by C.S.I.R.O. workers in Australia and he hoped to be able to obtain one for demonstration purposes at Manjimup.

VARIETY TRIALS

Eight different varieties of tobacco were under test in trial plots but it was explained that the trial must extend over several years in order to assess the effects of seasonal variations and soil conditions on the plants. The varieties under test included Virginia Gold, Hicks, Broadleaf, Mammoth Gold, Yellow Special, Cross Hickory, 401 and 402.

Another long-term series of experiments were those dealing with crop rotations. The advantages of obtaining other cash crops from land used to grow tobacco were obvious. A number of different rotations were being tested

Fig. 1.—Mr. T. G. Haney (centre, holding papers) describing one of the experimental plots.

which included crops such as sunflowers and green manuring rotations with lupins, rye and natural pasture.

INSECT PESTS

In the first of the series of interesting lecturettes, the Government Entomologist (Mr. C. F. H. Jenkins) said that although he was a non-smoker he fully appreciated the importance of the tobacco industry as it was the source of nicotine sulphate which was widely used as an insecticide.

Tobacco growers were menaced by numbers of insect pests, one of the most important of which was the cutworm, a caterpillar with many names only some of which were printable. The leaf miner which was also the larvae of a moth, was another pest which took heavy toll of tobacco crops each year.

Doubtless, said Mr. Jenkins, West Australian tobacco growers thought that they had all the tobacco pests in the world but this was not really the case. This State was free from several pests which provided serious problems in other countries and for this reason he stressed the need for reporting any new insects observed on tobacco plants. Prompt recognition of a new pest was more than half the battle in establishing effective control.

Mr. Jenkins said that clean cultivation was one of the essentials in reducing pests, as dirty paddocks provided hiding places and breeding grounds for many insects which later attacked the crop. Early preventive treatment was obviously better than eradication at a later date and he recommended growers to apply insecticides to the seed-beds in the first place and follow this up with routine applications at all stages of growth.

The time to attack the grasshopper pest, for instance, was in the early stages when the insects were at the "hopper" stage before their wings developed, and baiting along the boundaries of the tobacco crops would often destroy large numbers. During recent years, many new insecticides had come into being and the grower was often puzzled as to which one should be used. Experimental work was providing this information and the entomologist was fully aware of the risks that an insecticide may eradicate one pest and favour the increase of others by destroying harmless insects which often kept the pests in check.

PLANT DISEASES

The Government Plant Pathologist (Mr. W. P. Cass Smith) said that much of Mr. Jenkins' advice could also be applied to plant diseases. It was necessary for the pathologist to keep closely in touch with the industry in order to arrest any new diseases which might appear. Good crops were produced from healthy disease-free seedlings and half the battle was to ensure that no disease entered the plants at the early stages of growth.

It was better, he said, to raise seedlings on the property than to import them from elsewhere and take the risk of introducing new diseases. Before we had knowledge of the benzole method of control for blue mould, seedlings were often grown in Perth or even as far afield as the wheatbelt but it was realised today that seedlings from outside the area may introduce eelworm and other troubles.

Most tobacco diseases originated as seed-bed troubles and "damping off" had occurred this year in a number of areas. Damping off may kill many seedlings before germination had fully taken place. Plants not entirely killed may become cankered at the bases of the stems and such plants would prove unthrifty after planting out. Grey mould, a new disease on tobacco had made its appearance last year. This mould must be established on dead plant tissue such as that originally caused by damping off. The disease was caused by moulds which were widely distributed even in new soils but were much more prevalent in old paddocks, and the trouble was accentuated by wet soil conditions and a high degree of humidity. Light, free-draining soils were needed for seed-beds and the seeds should not be sown too thickly as disease was apt to spread rapidly in crowded plants.

The sterilising of seed bed soils with formalin and other chemicals was to be tried this year and it was hoped that fuller information on the effectiveness of this treatment would be available at a later date.

Some yellowing and distortion of leaves had occurred at Northcliffe after the seedlings had been treated with D.D.T. so that it was advisable to use the weakest possible strength.

POTATO GROWING

The Officer in Charge of the Vegetable Branch (Mr. E. T. Morgan) said that although it may appear out of place to talk of potatoes at a tobacco field day, the fact that the plants were of the same family might be offered as some excuse.

His real reason for speaking at the field day, however, was to point out that there was a serious need for an increase in summer-planted potatoes and potatoes were a payable catch crop which tobacco growers could often fit into their rotations.

As Chairman of the Potato Marketing Board, Mr. Morgan said that he was closely in touch with the problem of producing potatoes at the time when they were badly needed. At present, there is a Commonwealth-wide glut of potatoes but there is a serious need for more December-January-February plantings to provide supplies during the lean periods. Potatoes occupied a prominent place in all food production campaigns and the Manjimup area, which prior to the war years, produced only about 1,000 tons, is now producing about eight times that quantity. Under the new system of equalised freights the Manjimup, Pemberton or Northcliffe grower can market his potatoes without being penalised by his distance from the metropolis.

BUYERS' VIEWS

Mr. N. F. Emery, of the British Australasian Tobacco Company said that he was amazed by the number of people who were losing good quality leaf through not carrying out the recommendations of the Department of Agriculture. He stressed that Australia had an annual consumption of about 40,000,000 lb. of tobacco with an annual production of little more than a tenth

Fig. 2.—Visitors listening to one of the lecturettes.

of this quantity so that there was ample room for expansion of the industry in all States.

He said that the tremendous variety of soil types in the Manjimup area called for wide variations in the curing methods and suggested that a systematic soil survey of the area should be conducted as early as possible.

Mr. J. Scott, representing Godfrey Phillips, said that more attention should be paid to the control of leaf miner in Western Australia. In Queensland, the growers had established practically 100 per cent. control by using D.D.T. and although it was once thought that D.D.T. had a deleterious effect on tobacco leaf, it had now been shown that the effect on leaf quality was negligible.

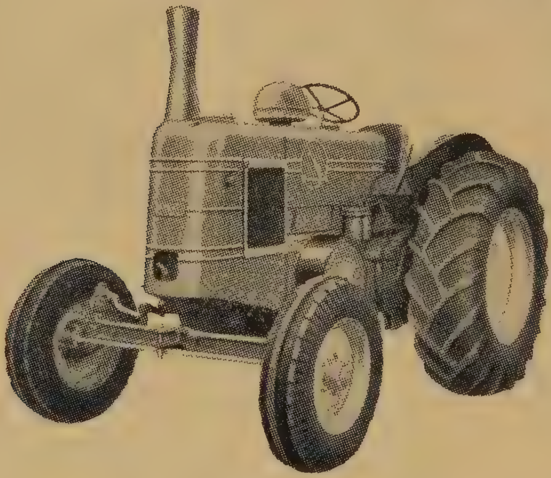
He felt that better-balanced fertilisers were needed in the Manjimup area and advised growers to be conservative in their choice of tobacco varieties. Do not rush in and plant large areas because one variety showed up particularly well in one season, he said, as the same variety might yield badly in another year. It was better to try small plots over a term of years before making any definite decision.

Mr. Scott said that he was not very pleased with most of the kilns inspected as the types used here had too many leaks and he had only seen one kiln that maintained the correct degree of humidity. Most of the temperatures were far too high, and this resulted in scorching. He advised growers never to let the temperature go above 180 degrees, or 170 for lighter leaf.

Baling in Western Australia could be greatly improved he said. Growers should not make small bales as these sustained too much damage in transit and he did not advise the making of any bales under 50 lb. Where there was insufficient leaf of one grade to make up the bale, it was better to make divisions in the bales, but growers should keep the grades of divided bales as nearly alike as possible. It was obviously an unsound policy to have high-grade leaf and a very inferior type of leaf in the same bale.

Fig. 3.—Inspecting trial plots.

FIELD-MARSHALL



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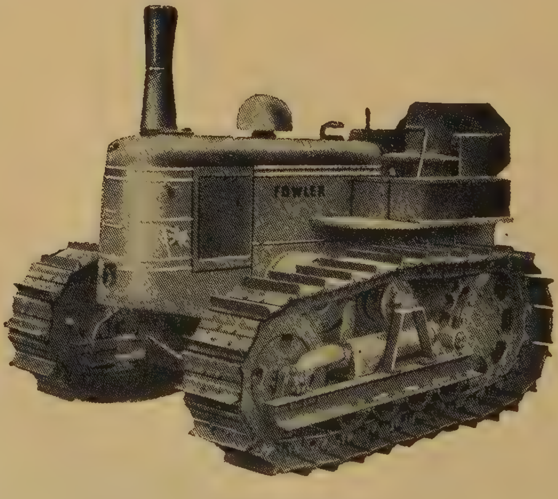

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CONCERNING MUSHROOMS

By H. M. GLOSTER

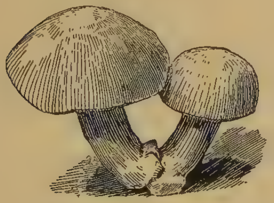
(Domestic Science Branch, Education Department).

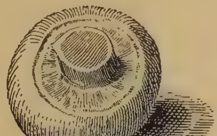
The Common or Field Mushroom.

BY most people, the umbrella-shaped fungi commonly seen in our paddocks during the autumn and early spring, are somewhat arbitrarily classed as either "mushrooms" or "toadstools," and it is generally believed that the mushrooms are edible and the toadstools are poisonous.

This is not strictly correct for the scientists tell us that all these umbrella-shaped fungi are species of toadstools. The name mushroom has come to be applied to a small number of the best-known edible forms but many other species are edible and only a small proportion are known to be poisonous.

Mushrooms have been relished as a food for many centuries. History records that the Emperor Claudius was poisoned by fungi prepared by his fourth wife, Agrippina and that the Czar Alexis also lost his life through eating what were apparently thought to be edible mushrooms.





EDIBLE VARIETIES

Most people will be content to leave any doubtful varieties to the expert mycophagists, as the fungus-eaters are termed, and possibly this is a wise move.

Where there is any doubt as to whether a fungus is edible it is well to leave it severely alone. The varieties generally eaten in Australia are the field mushroom and the horse mushroom. The field mushroom grows in grassy places and usually in sandy soil. It has a white cap with brownish scales and has a ring surrounding the stem below the cap. The "gills" on the underside of the cap are bright pink in colour when the fungi is fresh and become purplish-brown as it ages. The skin peels off readily. In its young stage the common mushroom has an almost globular cap and is commonly known as the button mushroom. These button mushrooms are in great demand as they are delicately flavoured and tender.

The horse mushroom was probably originally named the coarse mushroom. It is much larger than the field mushroom and specimens are often found measuring 12 inches and more across the cap. When young, the gills are not bright pink but pale and faintly salmon-tinged. They pass through a stage of dull pink to purplish-brown as the fungus becomes older. This mushroom also has a ring on the stem and this is stiffer and stands out more definitely than that of the common mushroom described above.

Horse mushrooms are very tough and even long cooking may fail to soften them. For this reason they are somewhat indigestible and many cases of illness after eating large quantities have not been due to any poisonous substance in the fungi but to painful attacks of indigestion.

PRECAUTIONS

Avoid any fungi which have very pale gills and any in which the base of the stem grows in a kind of cup below or near ground level. The base of the stem of the edible mushroom may be bulbous but the presence of a definite cup at the base of the stem is characteristic of some of the most poisonous species.

Avoid over-ripe mushrooms with black gills or those which have been attacked by insects.

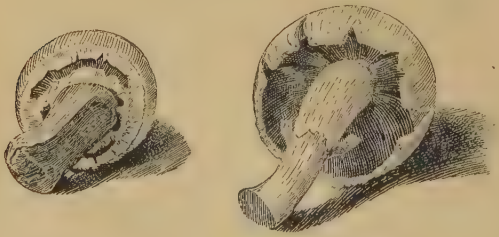
Avoid mushrooms which soften easily and those picked in dirty situations.

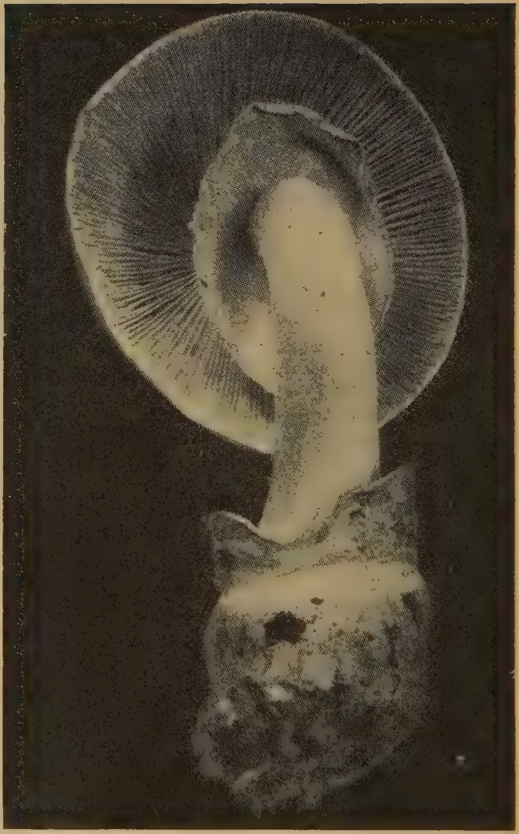
Avoid any fungi with a disagreeable odour or flavour and reject any which change colour to a marked degree on cutting or bruising and any which do not peel easily.

FUNGUS POISONING

The inedible fungi contain poisons which, if consumed, cause considerable irritation of the throat and stomach, together with vomiting, pain and diarrhoea.

Should such symptoms occur, send for a doctor immediately and give an emetic such as two tablespoons of salt in half a pint of lukewarm water. This emetic should be repeated every five minutes until vomiting occurs freely, after which the patient should be given a dose of castor-oil—two tablespoonfuls for an adult or two teaspoonfuls for a child. To relieve the pain, give olive or salad oil, medicinal paraffin, barley water or gruel.





A poisonous type. Note the cup at base of stem.

MUSHROOMS FOR FOOD

The edible mushroom consists largely of water but it contains small quantities of protein, traces of mineral matter and appreciable quantities of the B vitamins.

The chief value of the mushroom is for adding a pleasing and distinctive variation to the flavour of other foods. Mushrooms, if carefully cooked, are easy to digest but should be eaten fresh and in small quantities.

PREPARATION

When gathering mushrooms, always place them in the basket or other receptacle with the gills downward in the normal growing position so that grit will more readily fall away from the fungus. To prepare for cooking, peel the mushrooms and cut off the ends of the stalks then wash in cold salted water keeping the gills downward all the time. Shake and drain, washing a second time if necessary, then dry thoroughly on a cloth.

Mushrooms may be cooked and served in a variety of ways but the more simple forms of preparation are usually the best.

It is a mistake to add strong flavourings, and over-cooking tends to harden the mushrooms and spoil their flavour. They may be used as a main ingredient of a dish or as a flavouring for soups, stews and sauces. Mushroom ketchup has a piquant flavour and is often used to add zest to other dishes. A few simple mushroom recipes are given below.

Mushrooms for Breakfast or Lunch

Prepare the mushrooms as described.

Melt a little butter or margarine in the stew pan.

Add salt, pepper and a squeeze of lemon juice.

Fry mushrooms slowly until tender. (10 to 15 minutes.)

Serve hot on buttered toast.

Some people substitute a little grated lemon rind and a blade of mace for the lemon juice.

Another popular method is to cook the mushrooms in milk until tender, then thicken with a dessertspoonful of blended flour, flavour as above and serve hot on buttered toast.

A tablespoonful of chopped parsley may be used as a flavouring and a diced kidney cooked with the mushrooms gives a distinctive flavour.

Grilled Mushrooms

Select suitable mushrooms of equal size and prepare them as described.

Slightly score the outside of the mushrooms and lay them in a piedish then sprinkle with pepper and salt and pour some melted butter or salad oil over them.

Allow to remain in the dish for half an hour basting them occasionally with oil or butter.

Grease and heat the grid-iron and grill over glowing coals or a moderate gas-jet for about 10 minutes. The mushrooms should be turned over during cooking.

Serve on hot buttered toast and sprinkle a little lemon juice over each mushroom, or serve without toast placing a green butter-ball on top of each mushroom.

To make the green butter-balls take one ounce of butter, one teaspoonful of chopped parsley, one teaspoonful of lemon juice and salt and pepper to taste.

Chop the parsley very finely so that it will mix thoroughly and add a green tinge to the butter. Mix all the ingredients thoroughly, and form into balls which should not be placed on the food until just before serving.

Mushrooms with Scrambled Eggs

Take sufficient mushrooms to make one cupful when cooked, two or three eggs and seasoning to taste.

After cooking the mushrooms in butter or milk until tender, chop them finely and add beaten egg and seasoning then cook slowly until thickened, stirring frequently.

Serve at once on buttered toast.

Mushroom Omelet

Take sufficient mushrooms to make a quarter to half a cupful when cooked, three eggs, salt and pepper to taste, one tablespoonful of water and one teaspoonful of butter or lard for frying.

Cook the mushrooms, chop finely and season to taste.

Separate the yolks from the whites of the eggs and mix the yolks with the water, salt and pepper.

Beat the egg whites stiffly and fold into yolk mixture.

Melt the fat, pour in the mixture and cook gently until a light golden brown.

Place the cooked mushrooms on one half of the omelet and carefully fold the other half over them. Toast the centre of the omelet over glowing coals and serve hot at once, garnishing with cooked whole mushrooms and parsley.

To Bake Mushrooms

Take the required quantity of mushrooms, butter, pepper, salt and green butter-balls.

Prepare the mushrooms and remove the stems, then place them in a greased fireproof dish with the gills uppermost and sprinkle with pepper, salt and a few drops of lemon juice.

Lay small pieces of butter on top of the mushrooms and bake for about 15 minutes in a moderate oven.

Serve very hot in the dish in which the mushrooms are cooked and place green butter-balls on top.

Stewed Mushrooms

Take half a pound of mushrooms; half an ounce butter, half a cup stock; one tablespoon flour; one tablespoon cream (this may be omitted), two slices toast, salt, pepper and a squeeze of lemon juice.

Prepare the mushrooms leaving the small ones whole but cutting up any large ones.

Place in the stew-pan with butter and a sprinkle of water, salt, and a good squeeze of lemon juice, then stew very slowly with the lid on the pan for ten minutes.

Blend flour with stock and add to the mushrooms, then bring to the boil, stirring all the time. Allow to simmer for a further ten minutes, then add the cream and serve very hot on half slices of toast. A white onion may be cooked separately and cut up and added to the stew. Kidney cooked in the stock gives a good flavour to this dish.

Mushroom Sauce

Take one pound of mushrooms, one ounce of butter, one tablespoonful flour, one pint of milk, juice of half a lemon, salt, pepper, nutmeg or mace.

Prepare the mushrooms and cut in halves or quarters if necessary.

Melt the butter in a stew-pan and add mushrooms and lemon juice. Then cover the pan and cook slowly for 15 minutes.

Blend the flour with the milk, add to the mushrooms and stir until boiling point is reached, then simmer for 15 minutes and add seasoning to taste.

This sauce may be served with boiled meat or fish. If served with fish use fish stock instead of milk.

Cooked mushrooms may be added to any white or brown unsweetened sauce.

Mushroom au Gratin

Take half a pound of mushrooms, one ounce butter, one teaspoonful chopped parsley, half teaspoonful powdered herbs, two tablespoonfuls bread crumbs, two shallots and salt and pepper.

Prepare the mushrooms and cut off the stalks. Chop shallots finely, mix with herbs, parsley and half the bread crumbs.

Grease a flat pyrex dish with a little butter and sprinkle in half the chopped ingredients, then place the mushrooms on the top with the stalk sides uppermost and season with salt and pepper.

Sprinkle on the remainder of the chopped ingredients, cover with bread-crumbs and place small pieces of butter on top.

Bake for 20 minutes in a moderate oven and serve in the pyrex dish, garnishing with parsley.

Mushrooms as Flavouring

A few button mushrooms added to vegetable broth or mutton stew will make a very palatable variation to these dishes. The mushrooms should be prepared and added 15 minutes before serving.

Mushroom Ketchup

Gather early morning mushrooms, prepare as described and break into a basin.

Sprinkle with one ounce of salt to every two pounds of mushrooms and allow to stand for three days.

Simmer until all the juice is out of the mushrooms, then strain off the liquid.

Boil the liquid with the whites and shells of one or two eggs, then strain (this clears the liquid).

Return the liquid to the saucepan and to each quart of liquid add the juice of six shallots, half a teaspoonful peppercorns, half a teaspoonful ground ginger, six or eight allspice, one bay leaf and one tablespoonful of horseradish if liked.

Simmer for three-quarters of an hour, skim, strain, bottle and cork well. Dip the top of each cork into melted wax to make the bottle airtight.

Clearing with egg may be omitted if desired.

Pickled Button Mushrooms

Prepare a suitable quantity of mushrooms, dry thoroughly and rub with salt, then cook slowly at the side of the fire in the liquid which the salt draws from the mushrooms. Continue the cooking until the liquid has evaporated and season to taste with mace and pepper.

Cover with vinegar and bring to the boil, then hold at boiling point for a few minutes. Allow the pickle to cool slightly before pouring into bottles and cover the bottles when quite cold.

Mushroom Pie

Take half a pound of mushrooms, half a pint of milk, or milk and water mixed, one tablespoonful plain flour, four ounces bacon, seasoning to taste and six ounces of flaky pastry.

Cook the mushrooms in milk or milk and water until tender, then add one tablespoonful blended flour and stir over the fire until the mixture boils and thickens. Add seasoning to taste.

Arrange the mixture in a piedish in layers, with layers of bacon between, then cover with the pastry and bake in a hot oven until well risen and brown. Cook slowly until the pastry is cooked through.

Mushroom Patties

Prepare half a pound of mushrooms and cut into dice, then stew until tender. Add two tablespoonsful of plain white sauce.

Line some patty tins with flaky pastry, then fill with the mixture. Place a cover of pastry on top of each and bake in a hot oven until brown, then more slowly until the pastry is baked through. (About half an hour.)

On page 104 of the January-February issue, the notes on the food value of rock melons contained references to Vitamin E. These should have read Vitamin C.

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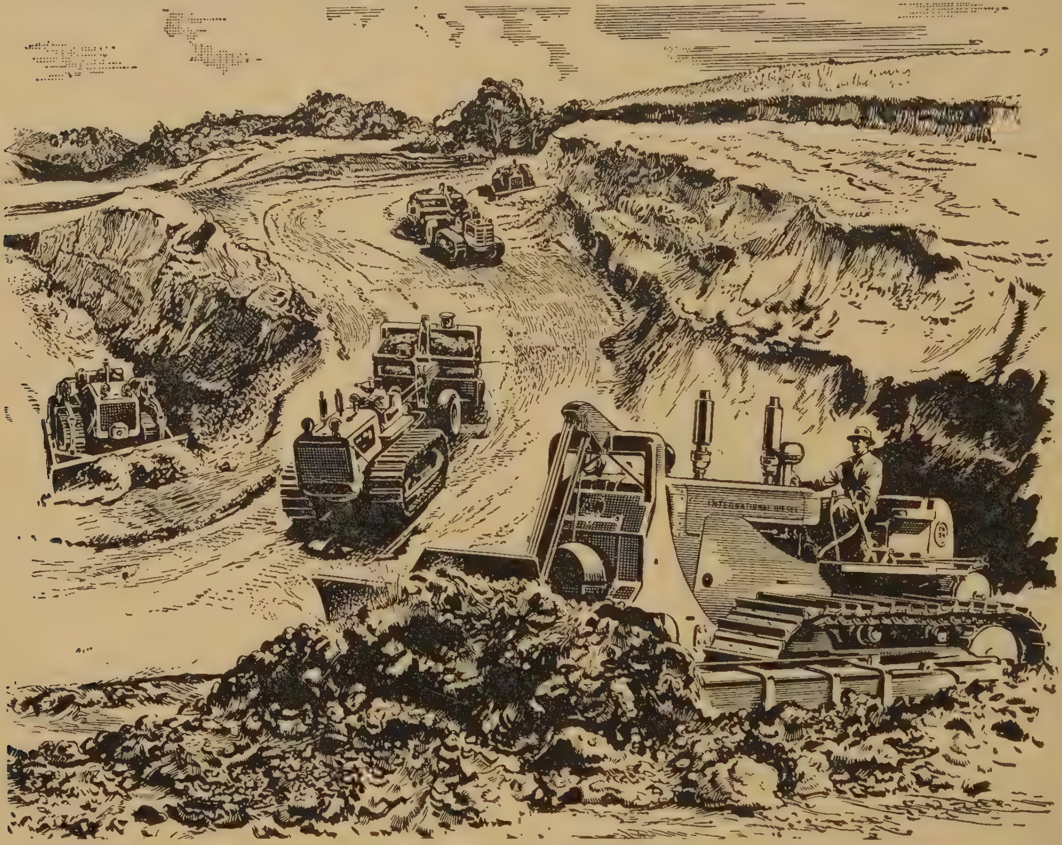

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SHRUBS FOR THE FARM HOME

By C. C. HILLARY

SHRUBS are of value in every garden and, when carefully chosen and properly planted in suitable positions, a collection can provide beauty and interest at all seasons of the year.

In dry country gardens especially, if shrubs are chosen to suit the particular locality, it is possible to add more permanent beauty to the home surroundings than with almost any other type of plant. Tall shrubs are useful for providing shade, and other suitable sorts may be planted in positions where they will give shelter from strong winds.

Varieties can be selected which will provide some flowers nearly the whole year round. Others are of value for the beauty of their foliage which may range through every shade of green and grey to deep copper and some, such as the acalypha and phyllanthus, through the more brilliant colours as well.

LITTLE ATTENTION NEEDED

Once they are properly established, most shrubs require little more than annual attention. This makes them doubly valuable to those who have but limited time to devote to the care of their gardens. When selecting shrubs, future disappointments will be largely avoided if they are chosen to suit the garden—its soil and environment. To buy "difficult" shrubs and then endeavour to make the garden suit their requirements is an invitation to trouble and often a cause of much unnecessary and useless work.

Soil preparation is of importance. Ground that is properly prepared at the outset will give the shrubs a good start and a good start in life is everything. Most shrubs grow better in loam than in sand and, if the soil is very sandy, it will be found an advantage to add a proportion of loam when the sites are being prepared.

Animal manure of some kind, or vegetable compost, should also be added to improve the fertility of the ground, and a larger feeding area will be provided for the roots if the manures are worked evenly through the soil to a depth of 18 inches or 2 feet. Bonedust, if available, is an excellent fertiliser for shrubs and the best place for it is in

THE CREPE MYRTLE, or LAGERSTROEMIA INDICA, blooms from December until March and is the loveliest of all our summer-flowering shrubs.

the lower soil. It dissolves slowly and provides a small but regular supply of plant food over a period of years.

If the shrubs are to be planted on heavy soil, provision must be made for adequate drainage in winter. A simple way of determining whether ground requires draining or not is to sink holes a foot square and two feet deep and fill them with water. If the water disappears within 24 hours the drainage is satisfactory. If not, then the area should be drained with agricultural (porous) drain pipes, placed two feet below the surface, and the water led to a sump or outlet in a lower part of the garden.

COTONEASTER.—This shrub with its prolific growth of colourful berries is an old-established favourite.

PREPARING THE SITE

A method of preparing sites for shrubs in sandy areas which I have found satisfactory, is as follows: Holes three feet in diameter are excavated to a depth of 18 inches—the top nine inches of soil being placed in one heap and the balance wheeled away. A barrow-load of loam plus some bonedust and five to six spadefuls of animal manure are thrown into the hole and dug as far and as evenly as possible into the lower layer of soil. The original surface sand, plus about another barrow-load of loam and some animal manure, are then placed in the hole and forked well together. This is followed by a good watering to settle the soil, and a week or two later the shrub can be planted.

Shrubs should be planted as soon as received from the nursery and care taken not to expose the roots to the drying action of the wind and sun. After planting, plenty of water should be applied to settle the earth particles around the roots. Deciduous shrubs should be hard pruned as soon as planted. Evergreen subjects, transplanted from pots, do not need any pruning if they are in good condition at time of planting.

MULCHES CONSERVE MOISTURE

In all districts mulches will be found of inestimable value to shrubs during the summer. Not only do they conserve moisture and help keep the soil around the roots cool, but they largely protect the lower foliage from injury by reflected heat on very hot days. The best material for mulches is old horse or cow manure, but lawn clippings, dried grass and decayed vegetable matter are also of value. The mulch should be spread well around the shrubs to a depth of three or four inches.

It is essential that all grass and weeds should be kept from encroaching close to the roots of shrubs. More especially is this necessary in the drier areas. After rain, and when the plants have been watered, the soil should be lightly stirred with a hoe. This cultivation, however, is rarely necessary with shrubs which have mulches around their base.

When making up any list of shrubs for planting, it is wise to include most of those that are known to thrive well in the district in which the garden is situated. Other shrubs can be included if, after enquiry; it would seem that they have at least a fifty-fifty chance of succeeding. I would stress, however, that is is useless to plant cold-country shrubs, such as rhododendrons, azaleas and forsythias, in the dry country districts of this State.

All of the following shrubs are well worth growing and may be expected to thrive in most gardens in the South-West, if provided with ample water until such time as they are well established:

Acalypha.—An attractive foliage shrub suitable for growing in any warm situation. It tolerates a variety of soils and once it is well established, withstands dry conditions well. Brownii and Marginata are the best varieties. (Height 4 ft.-6 ft.).

Bauhinia purpurea.—This large shrub produces richly-coloured flowers which resemble butterflies and in consequence it is often known as the butterfly shrub. Thrives best in loams and heavier soils. Deciduous. (10 ft.).

Broom.—Very suitable shrubs for dry situations. Most attractive in spring when the rich yellow blooms envelop every twig and stem. At other times the reed-like growth has little appeal. Will grow in most types of soil. (4 ft.-6 ft.).

Brunsfelsia latifolio.—A blue and white-flowered shrub of much beauty which grows as well in full sunshine as in partial shade. It thrives in any fertile soil and requires water in summer. It carries a profusion of large foliage throughout the year and the flowers are freely produced during summer. A shrub which no-one will regret planting. (8 ft.-10 ft.).

Callistemon coccineus.—The scarlet flowered bottle-brush which thrives in most soils and in most localities. Worth a place in every garden. (15 ft.).

Cotoneaster.—A very hardy berry shrub which will grow almost anywhere in most kinds of soil. The grey-green, evergreen foliage is always attractive and the masses of scarlet berries add a bright note to the garden in autumn and winter. The varieties pannosa, serotina, parneyi and simondsi all have some slight difference and all are well worth growing. (6 ft.-8 ft.).

Cassia condolleana.—A free-flowering, evergreen shrub which carries rich yellow blossoms in spring. It thrives in any sunny situation. Withstands dry conditions fairly well and will give a good account of itself in most districts. (6 ft.).

Diervilla (Weigela).—One of the loveliest of shrubs and a delight in spring when every twig and branch is covered with fascinating litttle bells in a pale shade of pink. Requires a certain amount of shade in summer, good soil and moisture. Deciduous. Should be hard pruned after flowering (8 ft.).

Duranta.—A useful, blue-flowered evergreen which grows to a height of 10 ft. Will thrive in most districts and withstands dry conditions fairly well. Prefers a sunny position, but is not exacting in its soil requirements.

Erythrina crista-galla.—A brilliant, crimson-flowered shrub which grows as well in full sunshine as it does in shade. Does not mind a hot position, but requires moisture in summer. (6 ft.).

Euphorbia pulcherrima.—This is the well-known Poinsettia which thrives in most soils which are well drained and reasonably warm in winter. It carries masses of scarlet in late autumn and winter and provides an attractive green background in summer. It responds well to hard pruning which should be done as soon as the scarlet bracts fall. (8 ft.-10 ft.).

Hibiscus.—A widely cultivated and most attractive shrub which thrives in most warm localities. It requires a fertile soil, but grows as well in one of sandy type as it does in loam. Most kinds open their flowers in the morning and they are finished and closed by dusk. The red and pink sorts are usually much more vigorous than the creams and other light shades. Four fine varieties are: Agnes Gault (crimson); James Scoble, (apricot); Mrs. J. H. Davies (salmon pink) and Apple Blossom (pale pink). (6 ft.-10 ft.).

Lagerstroemia.—This is the crepe myrtle and is quite the loveliest of all our summer-flowering shrubs. It opens its first crepe-like blossoms in December and often continues in flower until the end of March. It prefers a loamy soil, but does quite well in sandy ground which is well endowed with humus. There are several varieties, but those that find most favour are: Eavesii (pale mauve); Lavender Beauty (deep lavender) and very beautiful, Newmanii, the best of the reds, but not quite so free with its flowers; and indica (pink). The shrubs are deciduous and require hard pruning in winter. (6 ft.-10 ft.).

Lantana.—An exceptionally hardy shrub which will thrive in almost any kind of soil. Once established, it withstands dry conditions very well indeed. Useful for specimen shrubs and adaptable for hedges. There are several sorts in various colours, including the mauve-pink variety named Sellowiana which is so useful for growing over rocks, fences and old tree stumps. (4 ft.-10 ft.).

Nerium or Oleander.—This is one of the hardiest of all shrubs. It grows well in sand, loam and gravel and withstands drought remarkably well. It makes a splendid specimen shrub and is rarely without flowers during the summer months. It should not be planted close to bedroom windows since it has poisonous properties and dry pieces should never be used in kitchen stoves. (8 ft.-10 ft.).

Plumeria or Frangipani.—A cream and pink-flowered shrub with fragrant blossoms. It will grow well in all warm localities, but requires water in summer. Is as much at home in sandy soil as in loam or gravel. Deciduous. (6 ft.-10 ft.).

Pyracantha crenulata.—One of the best of the red-berried shrubs. Will grow in most districts and in most kinds of soil. It carries masses of tiny white flowers in spring and these are followed by red berries in autumn. The variety Lalandii, with orange-red berries, is equally hardy and equally beautiful. (6 ft.- 10 ft.).

Rondeletia.—One of the aristocrats of shrubland but suitable only for the cooler districts. Carries an abundance of large, light-green foliage and bunches of attractive salmon-pink flowers in spring and early summer. Does better in partial shade and requires plenty of water. (5 ft.-8 ft.).

Solanum phyllyreoides.—A rapid-growing shrub which carries masses of blue flowers. Is tolerant of a wide variety of soils and withstands dry conditions very well. (4 ft.-6 ft.).

Tamarix.—A graceful shrub which is useful for dry districts. Grows as well in sand as in loam and produces many panicles of tiny pink flowers in summer. (8 ft.-12 ft.).

FARMERS

This is YOUR Journal, and it has been written, edited and presented in a sincere endeavour to give you helpful information in an interesting manner.

We would like to have your views on the Journal—to know whether you like it or whether you don't. Drop a line to the editor and tell him the features you like and don't like in this issue—or the features you hope to see in future issues.

Tuart trees in a park-like setting near Busselton.
—Photo by courtesy of Forests Department.

TREES OF WESTERN AUSTRALIA

By

C. A. GARDNER (Government Botanist)

3—TUART (Eucalyptus gomphocephala *D.C.*)

EARLY settlers of the Swan River Colony soon learnt to value the timber of a tree which the aborigines called "Tooart." It ranked with that of the jarrah in local importance and, because of its toughness, was used for keelsons, stern posts, bridge supports, shafts and wheelright's work—in short for all purposes where great strength, solidity and durability were needed.

The Tuart is restricted naturally to the limestone areas of the western coastal plain extending northward from the Vasse district. Its southern limits are to be found along the Sabina River near Busselton, where the coastal limestone dips. To the north, the Tuart extends as a large tree in an almost unbroken belt throughout the limestone country as far north as Yanchep. As a smaller tree, up to about 40 feet in height, it may be found well to the north of the Moore River.

The best specimens of the Tuart are found in the Vasse district around Wonnerup and Ludlow, where individual trees attain a height of 140 feet, the trunks being up to 45 feet in length and 25 feet or more in girth. The Tuart does not grow mixed with other Eucalyptus trees except to a limited extent in the northern parts of its range where it occurs with jarrah and the marri or redgum.

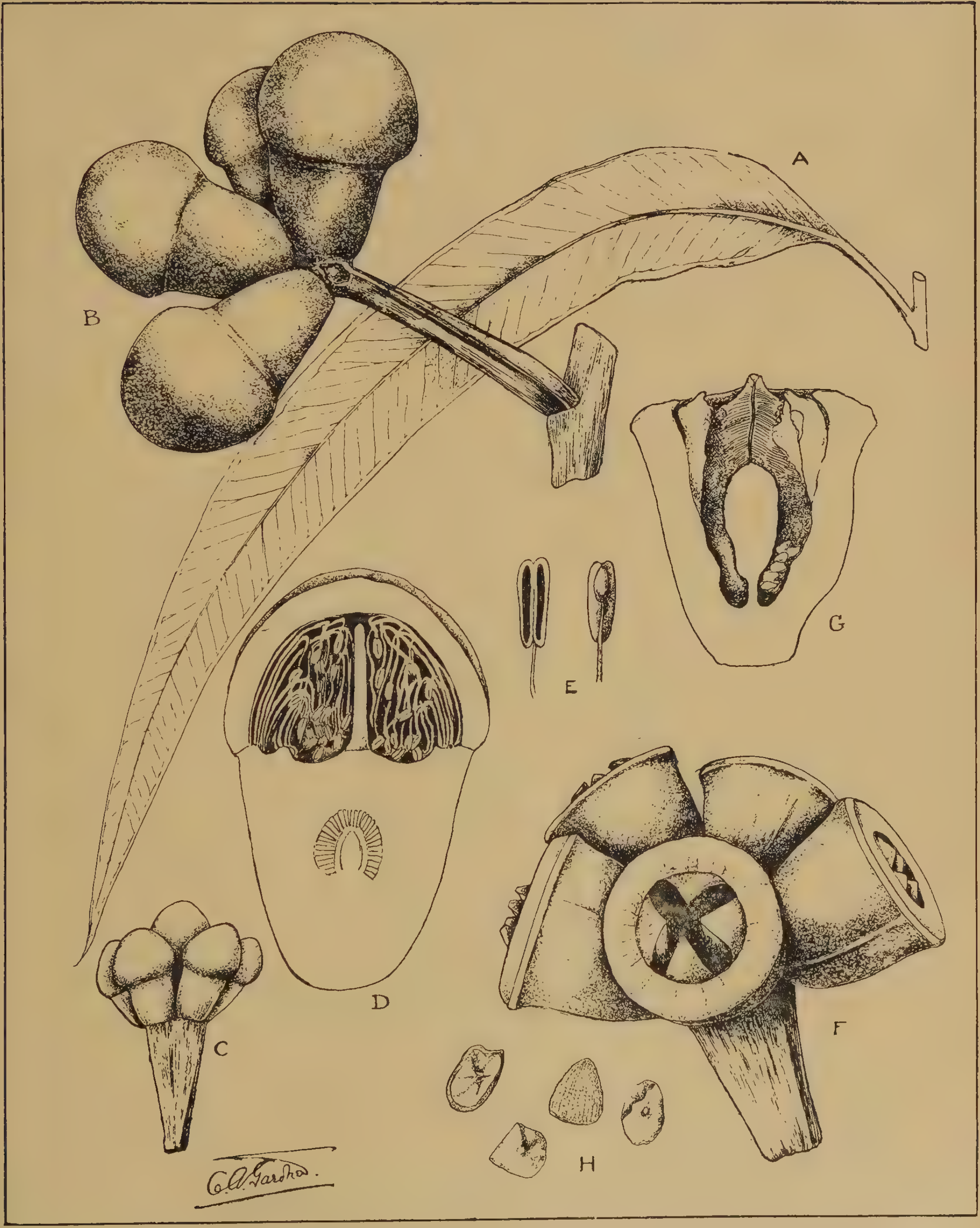
In the southern areas of its habitat where the largest trees are found and a true Tuart formation exists as a forest, the trees are associated with peppermints and other smaller trees which form an under-storey to the massive Tuarts. Unlike the jarrah and karri forests, the Tuart forest has comparatively little ground covering of small shrubs, and in consequence takes on a park-like appearance.

The Tuart is what would be termed a "box" tree in Eastern Australia, in other words, it is a completely rough-barked species with a pale grey, somewhat fibrous, close, dense bark which extends even to the branchlets.

The timber is a pale yellow in colour, and is very hard and dense with a strong interlocked grain — a characteristic which makes it desirable for use where strains or abrasions are encountered. For this reason it is largely employed in the construction of railway wagons, and formerly it was extensively used for the pins which supported telegraph insulators. The timber is reasonably termite resistant and is even stronger than that of the wandoo or whitegum.

The area of prime Tuart forest is of very limited extent, and the timber growing in State forests is reserved for Government requirements.

The flowers of the Tuart yield a profuse good quality nectar and Tuart honey is light in colour, of a pleasing flavour, and fine-grained when candied. Nectar yields are affected by damage to the flower buds caused by the Tuart bud weevil which bores through the young buds and causes them to fall. Tuart leaves yield 0.03% of oil.



TUART (Eucalyptus gomphocephala D.C.). A—Leaf; B— Buds (one and a half times natural size); C—Buds (half natural size); D—Section of flower bud (twice natural size); E—Anthers (much enlarged); F—Fruits (natural size; G—Section of fruit (slightly enlarged); H—Seeds (much magnified). Icon. origin.

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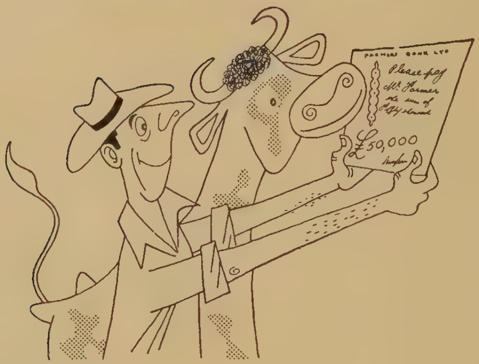

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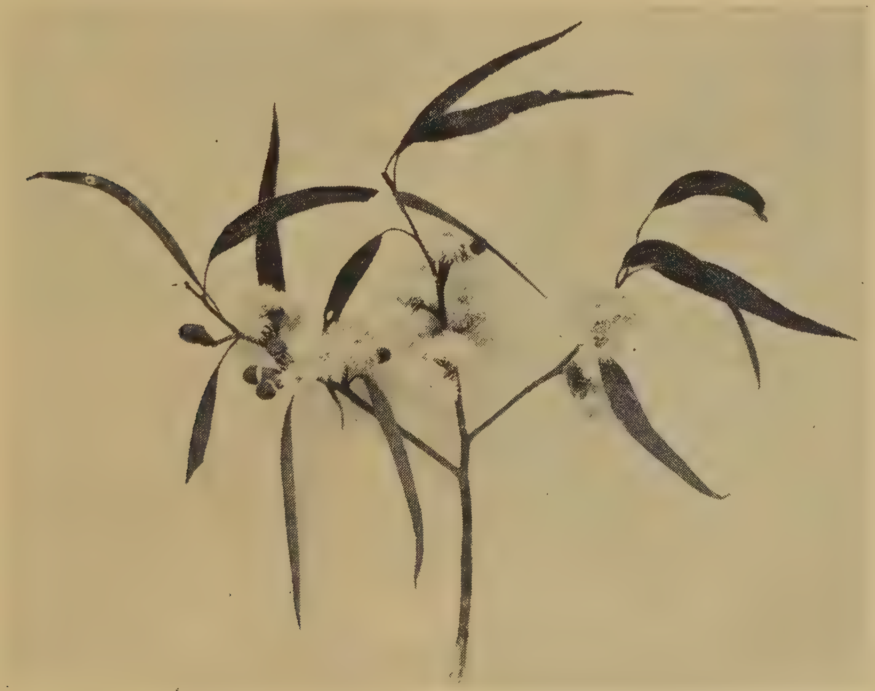
DESCRIPTION OF TREE

Typically 50 to 120 feet tall, with spreading or spreading-erect branches, covered throughout with a pale grey, rough, somewhat fibrous persistent bark. Leaves alternate, pendulous, lance-shaped, curved like a sickle, the midrib prominent, the lateral nerves spreading at a fairly wide angle, the intramarginal nerve distinct from the leaf-margin. Flowers in axillary umbels or heads, the common stalk much flattened and thick, and supporting from three to seven flowers which are stalkless. Calyx-tube bell-shaped, the operculum hemispherical to ovoid-hemispherical much broader than the calyx-tube. Stamens with yellowish-white filaments inflected in the bud, the anthers versatile (centrally attached), oblong, opening in longitudinal parallel slits. Fruits stalkless, bell-shaped, smooth or with one faint rib, three-quarters of an inch long, the disc slightly raised, narrow, the capsule deeply included in the fruiting calyx-tube with broad triangular truncate valves almost level with the orifice of the fruit.



Tuart flowers and leaves. Note operculum being pushed off on lower left-hand spray, prior to opening of the blossom.

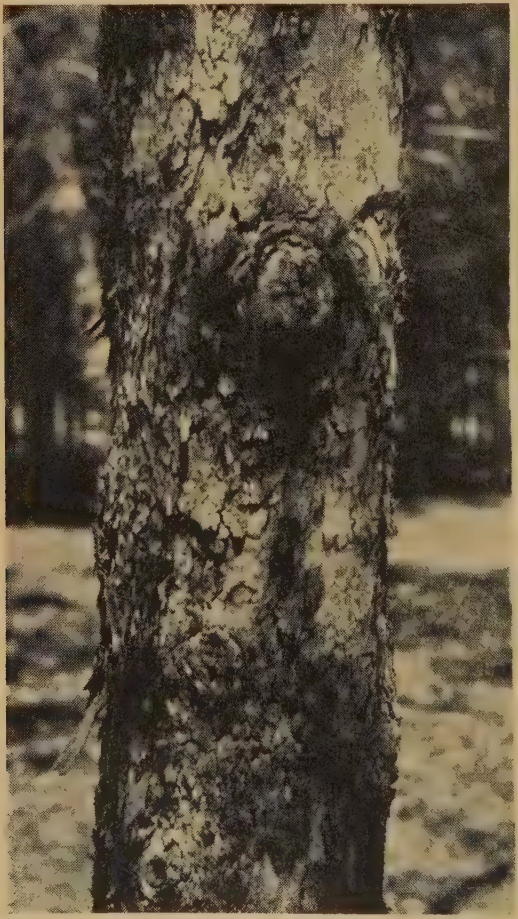
4—ILLYARRIE (Eucalyptus erythrocorys *F. Muell.*)

UPON his return from a trip along the old stock route between Perth and Geraldton in December 1851, James Drummond, writing to Sir William Hooker, Director of the Royal Botanic Gardens, Kew, mentions the discovery of a very striking Eucalyptus which he collected on limestone hills to the west of the "Valley of the Lakes." This tree was distinguished by its brilliant scarlet bud caps and bright yellow stamens expanded in a cross-shaped pattern.

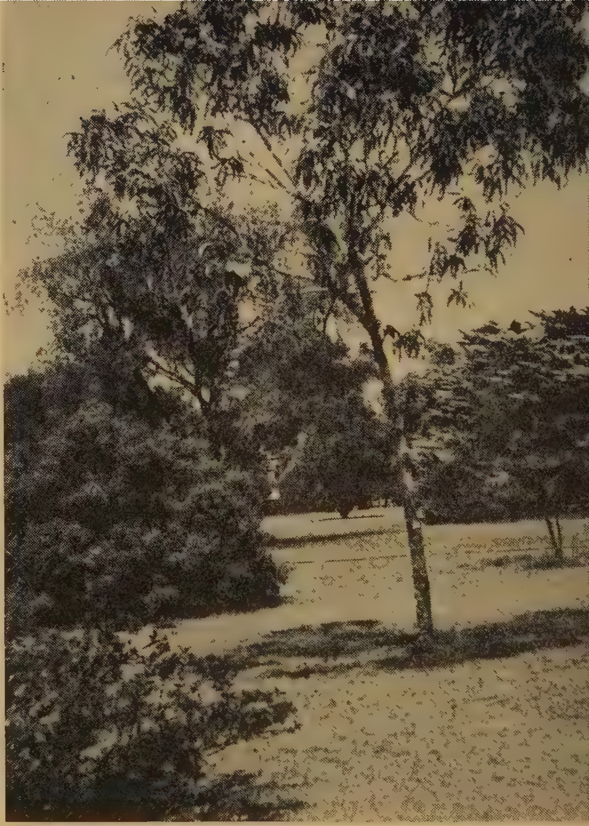
Shortly afterwards, Augustus Oldfield, a botanist collecting specimens between Port Gregory and Shark Bay, encountered the same tree which the local aborigines called the "Illyarrie."

It was not until 1860, however, that Baron von Mueller gave the plant the name of erythrocorys, in reference to its bright red bud-cap.

The species remained in obscurity, however, until in recent years it was found in some abundance at Bookara Siding not far from Dongara. Today it is found in many parks and gardens both in the city and in the country, and it is successfully cultivated abroad.



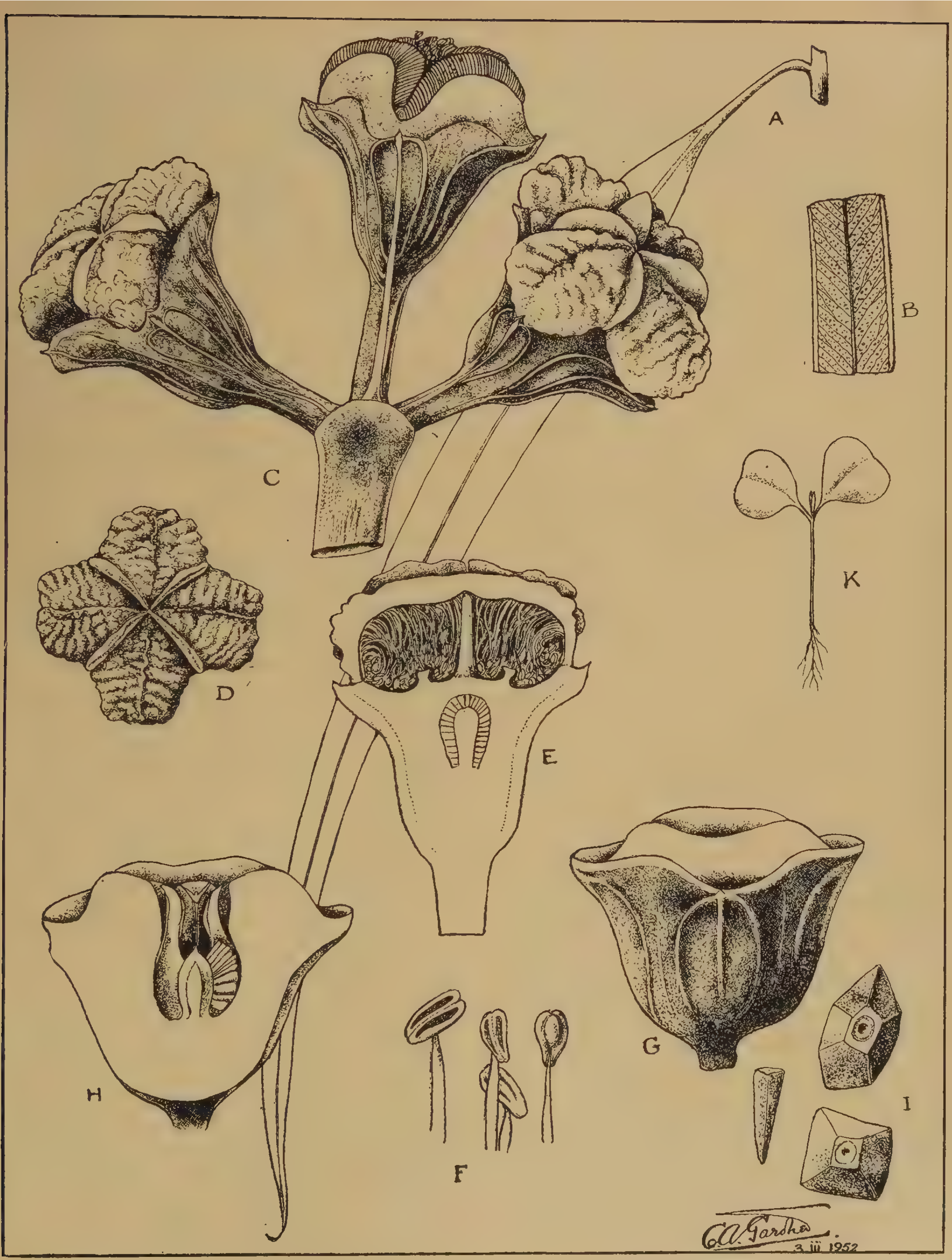
Close-up of the trunk of the Illyarrie, showing white bark partly covered by patches of older bark.
—Photo, J. A. Mallett.



ILLYARRIE.—This specimen is growing near the entr
to King's Park, Perth
—Photo, J. A. Ma

Of no value to the sawmiller—it is a small tree and the timber is brittle and short-grained—the Illyarrie is one of the most decorative species of the genus and deserves to be better known. It is by far the most spectacular of those species of Eucalypts in which the stamens, instead of being in a continuous series, extend in four radiating clusters. The contrast of scarlet, yellow and green found in the buds and flowers when the tree is in blossom make it a desirable specimen for any garden.

The Illyarrie has proved its ability to adapt itself to many classes of soils and, although naturally restricted to the coastal limestone, it has proved hardy in cultivation in the low rainfall areas, in heavy soils and in granitic loams.



ILLYARRIE (Eucalyptus erythrocorys F. Muell.). A—Leaf (slightly reduced); B—Portion of leaf showing nervation and oil-dots; C—Umbel of buds in various stages of development, the central one showing the bud-cap fallen (one and a half times natural size); D—Operculum or bud-cap; E—Section of bud (almost twice natural size); F—Stamens (much enlarged); G—Fruit (natural size); H—Section of fruit showing seeds; I—Seeds (much enlarged); K—Seedling, showing expanded cotyledons. Icon. origin.

Nothing seems to be known concerning its value either as an oil-yielding tree or as a nectar producer, although the flow of nectar seems to be copious.

DESCRIPTION OF TREE

The Illyarrie is easily recognised among other species of Eucalypts because of its four-lobed biretta-like scarlet operculum together with its yellow flowers, the stamens of which are in four tufts giving the open flowers a cruciform appearance.

It is a tree of 15 to 25 feet in height with spreading branches and opposite pendulous narrow green leaves. The bark is white, occasionally with older bark forming a persistent covering in patches, at other times it is clean and white. The timber is pale and brittle and of no commercial value.

The young leaves of coppice shoots or seedlings are broad and rigidly hairy, and pale green or grey in colour. The narrow pendulous leaves are indistinctly veined and the intramarginal nerve (the nerve or vein parallel to the margin) is at some distance from the margin of the leaf. The leaf is fairly copiously dotted with oil cavities.

The flowers are produced in umbels of three, the common stalk or peduncle being thick and flattened and of a purplish colour, as are the individual flower-stalks or pedicels. The buds are large and the green calyx-tube is four-toothed. Each tooth is continued downwards as a rib on each side of which is another rib which unites with the central rib some distance below the tooth.

The operculum is of brilliant scarlet, in marked contrast to the green calyx, and is cross-shaped and more or less transversely wrinkled or warted with a narrow median crest. Alternating with these four lobes are four erect ridges which protrude slightly above the general level of the operculum. It is indeed an exact replica of a biretta.

The stamens are inserted on the margin and inner side of a four-lobed ridge immediately inside the bud cap or operculum, and are in four clusters so that when the flower opens, the sulphur-yellow filaments expand in a cruciform pattern.

A section of the bud shows a circular ridge between the staminal ring and the style, and this in fruit develops into the raised summit of the disk. The stamens have versatile (centrally attached) oblong-shaped anthers which open in parallel longitudinal slits. They are all fertile.

The fruit is widely bell-shaped, and exhibits the same ribbing as the calyx-tube when in the bud stage; the summit of the fruit or disk has four depressions corresponding to the intervals between the tufts of stamens, while inside there is a convex elevation dipping in the centre towards the capsule. The fertile seeds are almost black and more or less pyramidal in shape, while the sterile seeds (packing) are narrowly wedge-shaped. The Illyarrie is one of the most ornamental of the species of Eucalyptus and is adaptable for all classes of soil. It thrives inland as far as Tammin in heavy soils, and is equally at home in sand despite the fact that under natural conditions its distribution, like that of the Tuart, is governed by the presence of coastal limestone.

The tree is not uncommon in various places between the Murchison River and Jurien Bay. It is common at Bookara Siding near Dongara, and fairly large trees occur on the limestone to the south of Lake Logue and on the limestone flats, while to the south-west of Cockleshell Gully the trees are found in a reduced form on steep limestone hills.

◆

POISON Plants OF WESTERN AUSTRALIA

By C. A. GARDNER,
(*Government Botanist*) *and* H. W. BENNETTS, D.V.Sc. (*Principal, Animal Health and Nutrition Laboratories*)

TOXIC PLANTS OF THE GENUS ISOTROPIS

Including the so-called "Lamb Poison"

THE genus Isotropis is restricted to Australia. Of the total of nine species six are recorded in Western Australia, two of them being known as "Lamb poisons" while the remainder have no common names. Three are known to be toxic to stock, but concerning the remaining three we have no definite information.

Isotropis takes its name from *Isos*, equal, and *tropis*, the keel of a vessel. The keel of a peaflower is formed of the two innermost petals which enclose the stamens and ovary. While these two (usually united) petals are usually shorter than the wings and the outermost "standard" petal, in Isotropis they are about as long as the wings.

There is usually some common character, which can be used in the field to distinguish the various genera of plants. With the toxic species of Gastrolobium and Oxylobium the opposite leaves and terminal arrangement of the flowers is a useful guide. In Isotropis the outermost erect petal (the standard) is radially striated or veined with lines extending from the middle to the margin or nearly so, and forked towards their extremities. These veins are a deep purple in colour. This character alone serves to separate Isotropis from all other native legumes in which the calyx is deeply cleft and in which the 10 stamens are free. Additionally the pod contains from seven to 40 seeds

POISONOUS PROPERTIES

For many years, stockowners in this State have been positive that some species of Isotropis, variously known as "Lamb poison" or "pea-blossom Poison", are poisonous to stock. The field evidence for at least two species, *I. cuneifolia* and *I. juncea*, is very convincing although a series of feeding tests carried out over a period of years have, almost without exception, given negative results. Bennetts (1935), however, confirmed that *I. cuneifolia var. parviflora* may be highly poisonous to sheep when flowering, while flowering plants of *I. juncea* were, in one test, shown to be toxic for guinea pigs.

The northern species, *I. atropurpurea* was also proved poisonous in tests carried out in Eastern Australia and reported by the Poison Plants Committee (1934). Stock mortalities in the De Grey and Fortescue regions of W.A. have been attributed to this species.

The symptoms and post-mortem appearances described for poisoning by *I. cuneifolia and I. atropurpurea* are very

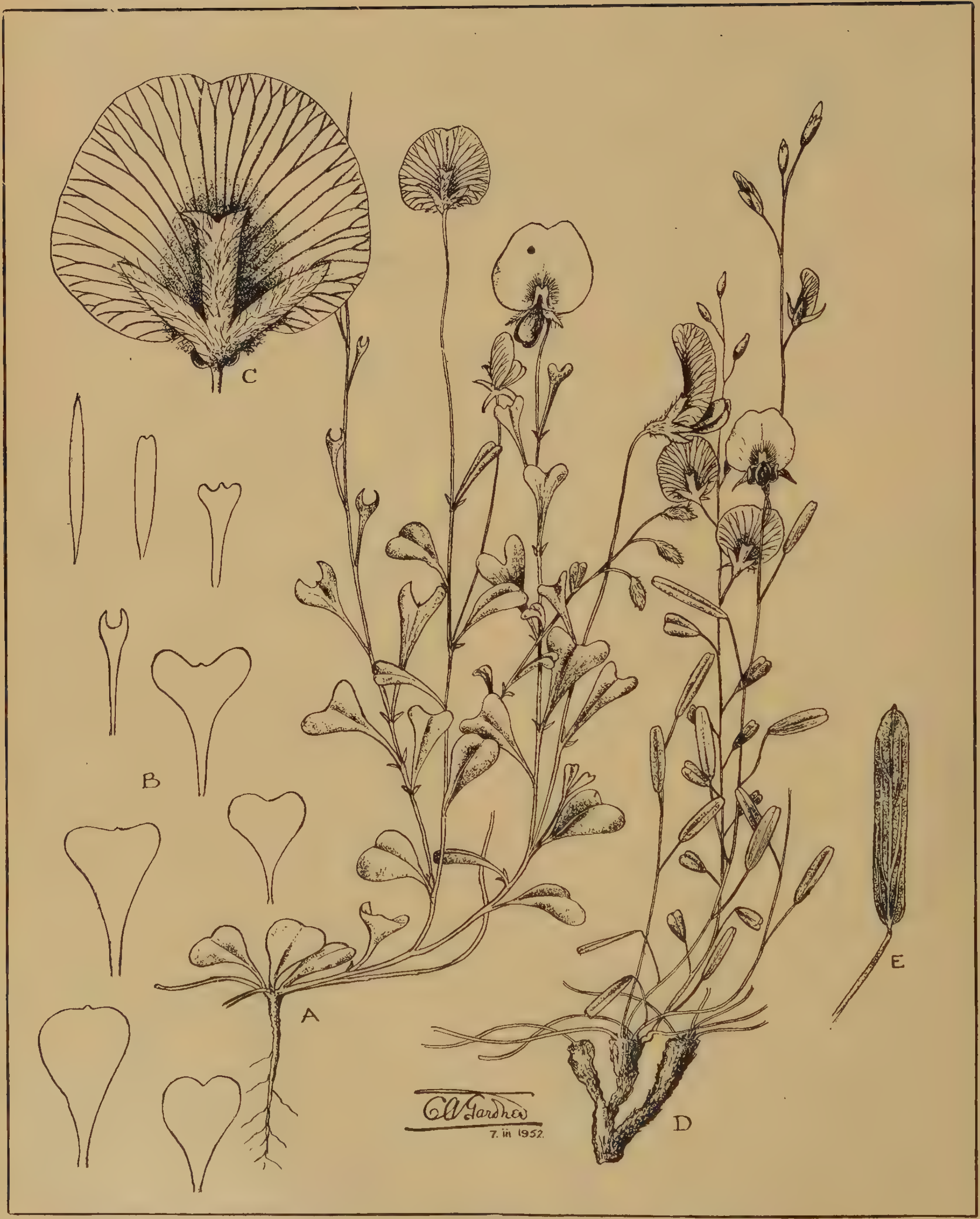


PLATE 1.

Isotropis cuneifolia (Sm.) Domin. (A-C). A—Habit (natural size). B—Various leaf forms. C—Flower seen from behind, showing the united upper sepals. Note striations on the back of the standard, and the hairy calyx.

Isotropis juncea Turcz. (D-E). D—Habit, showing stock. E—Leaf, showing the articulation on the stalk immediately below the base of the leaf-blade. Icon. origin.

similar to those encountered in mortalities in Western Australia which have been attributed to Isotropis spp. generally.

We have considerable evidence that the poisonous properties of species vary greatly with locality, with stage of growth, and with the form or variety of the species. *I. cuneifolia*, for example, undoubtedly has been responsible for numerous mortalities of cattle and sheep in the Gingin and Hill River districts, and in the South coastal areas from Albany to Esperance, whereas in some other localities where it occurs commonly stock have not been reported affected by it. This species in particular, on field evidence, seems to be dangerous only during the flowering and fruiting stages of growth.

The negative results of many feeding tests carried out in this State are attributed probably to the variation in toxicity referred to and to the fact that samples tested commonly have not been in a fresh condition; there is some evidence that toxicity may diminish rapidly after picking. On the other hand, however, the positive results with both *I. cuneifolia* and *I. atropurpurea* were obtained with plants not freshly picked—the latter material was "old dried plant".

Although these two species are the only ones definitely proved poisonous, on available evidence all should be regarded with suspicion.

The poisonous principle of *I. atropurpurea* is thought to be an alkaloid.

Animals Poisoned—Cattle and Sheep.—It has been stated frequently, in this State, that lambs particularly are susceptible. There is little definite evidence that this is so, and it is highly probable that much of the lamb mortality attributed to Isotropis during the earlier years of settlement, was actually due to a bacterial disease, entero-toxaemia, which commonly occurs at the same time as the plants are flowering.

Amount Required to Cause Death.—Under experimental conditions the following amounts were proved poisonous:—

Cattle—4 ozs. of *I. atropurpurea*, "old dried plant" killed a calf 3 months old.

Sheep—2¾ lb. of *I. cuneifolia var. parviflora*, green flowering plant fed one day after picking killed two sheep. Under natural grazing conditions much smaller quantities appear to be fatal.

Symptoms.—Field evidence indicates that a relatively large amount of plant may cause sudden death, without definite symptoms being noted, within several hours of sheep or cattle having access to the plant.

The following symptoms, however, are commonly noted:—Dullness, tucked up appearance, roach back, loss of appetite, diarrhoea, which becomes persistent; within a day or two blood and mucus are voided. Affected animals become

KEY TO THE SPECIES

A. Northern and Eremean species (as far south as the Murchison District): flower purple or violet, with darker veins. Pedicels twice as long as the calyx or less.
  B. Leaves broad, densely rusty-velvety; broad at the base, wings and keel petals almost as long as the standard. Shrub .... 1. I. atropurpurea
  B. Leaves narrow or at least narrowed towards the base; petals about equal. Undershrubs.
    C. Leaves linear .... 2. I. Forrestii.
    C. Leaces cuneate-ovate .... 3. I. canescens.
A. South Western species: flowers yellow or orange-yellow, veined with prominent purple radiating forked veins which extend to the margin; wings and keel much shorter than the standard.
  B. Flowers racemose, the pedicels rarely much longer than the calyx.
    C. Stems erect, rush-like, leafless except near the base; calyx silky-pubescent. ... . 4. I. Drummondii.
    C. Stems ascending; leaves narrow, entire, jointed at the junction with the pedicel; calyx glabrous. .... 5. I. juncea.
  B. Flowers on long solitary pedicels in the upper axils; leaves broadened upwards, usually notched at the apex; calyx usually silky-pubescent .... 6. I. cuneifolia.

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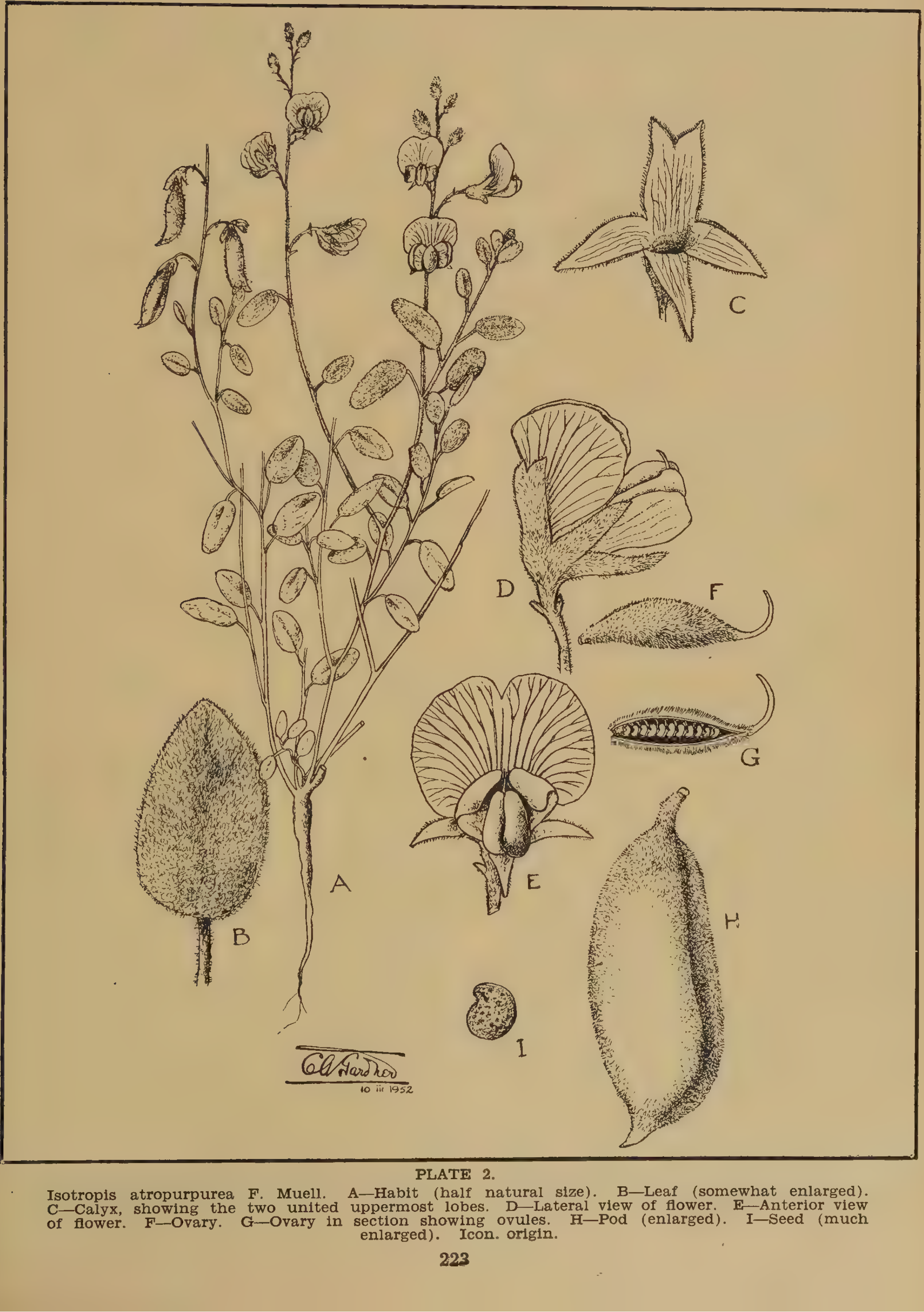
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PLATE 2.

Isotropis atropurpurea F. Muell. A—Habit (half natural size). B—Leaf (somewhat enlarged). C—Calyx, showing the two united uppermost lobes. D—Lateral view of flower. E—Anterior view of flower. F—Ovary. G—Ovary in section showing ovules. H—Pod (enlarged). I—Seed (much enlarged). Icon. origin.

progressively weaker and lie down frequently; when standing they are unable to fully extend the hind limbs. Death occurs within 2-7 days.

Post-Mortem Appearances.—There is more or less severe inflamation of the fourth stomach and intestines; the large bowel may show extensive haemorrhage and ulceration of the inner lining and contents may be blood stained. The liver is congested, but kidneys pale in colour.

There may be extravasations of straw-coloured fluid below the skin and into the body cavities—in one experimental sheep an early stage of pneumonia was present.

Microscopic examination showed evidence of marked kidney damage—hyaline casts being present in many tubules.

DESCRIPTION OF SEVEN SPECIES (TO BE USED WITH REFERENCE TO THE PLATES)

1. *I. atropurpurea F. Muell.*

A shrub, usually about 60 cm. tall (two feet) with erectly branched twiggy stems arising from a tap-rooted stock, the whole plant covered with dense interlocked velvety yellowish or rusty hairs. Leaves alternate on slender stalks usually about 5 mm. long, with two minute stipules at the base, and a more or less distinct articulation at the point of attachment of the leaf blade, which varies in shape from oblong to elliptical or sometimes almost orbicular, and usually less than 12 mm. (half an inch) in length, rarely the leaf longer or narrower

Flowers arranged in racemes which terminate the branches, usually the individual flowers some distance apart, on erect or spreading pedicels (stalks) which are subtended by a single bract at the base and two small bracteoles opposite each other and usually situated above the middle. Calyx divided almost to the base into five lobes, the two uppermost being united almost to the summit and forming a two-lobed upper lip, the remaining three lower lobes narrow and acute, all velvety hairy. Corolla delicate, purple, only slightly longer than the calyx, glabrous (hairless), the broad standard deeply notched at the top, and veined with conspicuous radiating deep purple lines which fork upwards and extend almost to the margin; wings and keel somewhat shorter than the standard, striated. Stamens ten, all free from each other. Ovary densely velvety, on a very short stalk, containing 14-20 kidney-shaped ovules. Pod oblong, turgid, somewhat impressed on the lower side, softly velvety-hairy.

Northern Pastoral areas (excluding Kimberley) as far south as Lake Austin, in stony sandy soil and on stony hills.

A pale flowered plant (var. alba) was collected by H. S. King and Lefroy near Lake Austin in 1890. The leaves are narrow and acute.

I. atropurpurea is responsible for considerable losses in stock in the North West, especially amongst sheep in the De Grey and Fortescue districts.

2. *I. Forrestii F. Muell.*

An undershrub with weak erect flexible stems up to 45 cm. (18 inches) tall, the stem erectly branched, sparsely covered, (especially on the younger parts) with short golden hairs lying close to the surface, the older parts glabrous (hairless). Leaves few on long slender stalks, narrow, about 12 mm. (½ inch) long, and shorter than or scarcely longer than the leaf stalks which have a joint or articulation at the top, the leaf flat or grooved on the upper surface almost or quite devoid of hairs. Flowers deep bluish-purple, in long racemes which terminate the branches, the flowers remote from each other, on slender stalks which have a small but broad bract at the base and two opposite bracteoles close to the flower.

Calyx seven to eight mm. long, sparsely silky-hairy, divided almost to the base, the two uppermost lobes united almost to the summit, and forming a narrow upper lip, the three lower narrower and acute, all curving backwards in the open flowering stage. Standard broad, purple-blue, about as long as the calyx, notched at the summit, striated with deep purple lines which are forked upwards and extend almost to the margin of the petal, and additionally with a white patch at the base of the petal above its stalk or "claw". Wings and keel about as long as the standard, deep violet with dark veins. Stamens 10, all distinct and free. Ovary shortly stalked with about 13-15 ovules, shortly and densely yellow hairy tapering into the slender incurved style which is hairy in the lower part. Pod inflated, ellipsoidal, velvety silky narrowed at the base into a short stalk.

Near the Gascoyne River, J. Forrest (1882); Gascoyne River, J. S. Dalton.

Apart from these two records of an apparently rare species we have no knowledge concerning this plant. It is probably toxic to stock.

3. *I. canescens F. Muell.*

We know very little concerning this plant collected by Young at Victoria Spring in 1875. It is known only from the original collection and has not been seen since. It is a trailing plant with stems two to five inches long, from a simple slender root, and the whole plant is silky-hairy. The leaves are more or less wedge-shaped and rounded at the top, and about half an inch long, not evidently veined on very short stalks, with small acute stipules. The flowers are borne in few-flowered racemes (the same arrangement as in I. atropurpureaum), the bracts are small and lance-shaped. The flowers are on stalks smaller than or scarcely longer than the calyx which is one quarter of an inch in length and hairy-silky with minute hairs. The petals have not been observed, neither have the stamens. The pod is swollen and about an inch in length, ellipsoidal and oblong in outline, and the numerous seeds are somewhat heart or kidney shaped, on long slender stalks

4. *I. Drummondii Meissn.*

This species can usually be easily recognised by reason of its erect rigid, usually leafless, rush-like stems which attain a length of over 12 inches, and in which the leaves when present are mostly on the lower parts of the stems only.

The root is a thick vertical corky taproot forming a stock at the top from which the erect stems arise. The leaves are, when present, narrowly wedge-shaped but acute at the top and gradually taper at the base into a stalk which is continuous with, and not jointed to the leaf blade, the blade is prominently net-veined, hairless, and up to an inch in length; the stipules at the base of the leaf stalk are slender and almost hair-like. The flowers are arranged along the upper part of the stem in a raceme of usually many flowers on slender stalks shorter than, or scarcely longer than the calyx, the calyx, its stalks, and the upper part of the stem being grey-downy. The calyx is like that of the other species, nearly half an inch long, but less deeply cleft into lobes, and is grey-hairy-downy. The flower stalk has a very small bract at the base and two opposite bracteoles immediately below the calyx. The standard is conspicuously striated with deep reddish purple veins, radiating from the centre and extending to the margin as in the other species, forked towards the margin of the petal. The wing and keel petals are shorter than the standard and elegantly veined. The 10 free stamens are enclosed within the purple united keel petals.

The ovary is narrow, white-hairy on a short stalk and contains 30-40 or more ovules. Ripe pods have not been seen, but in the immature state they are long and narrow on a slender stalk, or the pedicals are reflexed.

If correctly matched, specimens in pod from Balladonia and from the Jerdacattup River,—in the latter case said to be responsible for heavy losses among sheep—have turgid pods about one inch long.

This plant has a small range extending from Pingelly and Konongorring to Ballidu and as far east as Boorabbin and Balladonia. Along the South Coast it extends on the sandy coastal country from the Phillips River and Hopetoun districts to the eastwards. The species is closely related to the Common Lamb Poison (I. cuneifolia) but may be distinguished by its narrow entire acute leaves which are usually on the lower parts of the plant, or quite absent, and by the shorter flower stalks of the many flowered erect racemes.

5. *I. juncea Turcz.*

Stems numerous, slender, prostrate or variable, ascending from a thick woody stock, wiry flexible hairless as well as the whole plant. Leaves usually few, variable in shape and size, on a rather long slender leaf-stalk which is jointed immediately below the base of the leaf-blade, the leaf-blade wedge-shaped to narrowly oblong or linear, obtuse, rarely notched at the apex.

Flowers arranged in slender terminal, few flowered racemes (see plate) the flower-stalks almost thread-like, shorter or rather longer than the calyx, each subtended by a short broad minute bract and with a pair of bracteoles immediately below the calyx. Calyx hairless, about a quarter of an inch long, deeply divided, the lobes narrow, the two uppermost united to the top, all reflexing after flowering. Flowers orange-yellow, the standard half an inch long, and more in breadth, striated with prominent radiating forked purple veins, the wing and keel petals shorter. Ovary almost without a stalk, with about 30 ovules.

6. *I. cuneifolia (Sm.) Domin.*

Herbaceous perennial or subshrub with a strong root and prostrate, ascending, or rarely erect stems, hairy with rather long scattered hairs. Leaves variable, the lower usually broadly or narrowly wedged-shaped or occasionally heart-shaped tapering into the leaf stalk and not articulated or jointed at the base of the leaf, the upper leaves usually narrower, but typically two-horned or two-lobed. Very occasionally a few of the upper very narrow and without teeth or lobes. Stipules broad and short rarely lanceolate.

Flowers solitary in the axils of the leaves, sometimes appearing racemose, but then the pedicels with two stipules and much reduced or bract-like leaf at the base (in all other species the flower stalk is subtended by a solitary bract). Pedicals elongated, often three to five inches long, with two bracts at the base of the calyx often spurred at the base. Calyx divided almost to the base, glabrous or hairy, often over ½ inch long, the upper lobes forming a truncate upper lip. Standard large, elegantly nerved, yellow or orange, with deep purple forked veins. Wings and keel shorter. Ovary on a short stalk, hairy, containing numerous (about 30) ovules. Pod ¾ to one inch long, much contracted towards the base, pubescent.

This is the common species of the South-West extending from the vicinity of the Irwin River to the south coast. It is common on the western coastal plain and in the Vasse district, and its flowers are called "granny bonnets" by children.

Reports on this species by stockowners in various parts of the South-West have indicated that in some localities the plant is regarded as being harmless, while in others the plant is known to be toxic. An examination of specimens in the State Herbarium has enabled the material of this species to be separated into three forms or varieties, of which one is known to be toxic. The following key will serve to separate these forms.

KEY TO FORMS OF I. CUNEIFOLIA

A. Leaves all dilated upwards, lobed, emarginate, retuse or truncate; stipules rather broad; calyx hairy, usually densely so.
  B. Stipules foliaceous, usually with one lateral tooth; usually half or more than half as long as the leaf; plant coarsely hairy .... forma α
  B. Stipules small, usually ovate to lanceolate .... forma β

A. Upper leaves narrow-linear, entire; stipules linear to narrow-linear; calyx glabrous or with a few long erect, mostly marginal hairs .... forma γ

1. Forma α This plant occurs in the Moora district. It was sent in without any collector's name. It is apparently of dwarf habit and erect growth and can be distinguished by its leaf-like rigid and often toothed stipules.
2. Forma β This is the typical form of the South-West with variable foliage, usually broadly wedge-shaped leaves (at least the lowest) and a hairy calyx. In this form the flowers sometimes appear to be in racemes, but then each pedicel is subtended by three bract-like structures (a reduced leaf and two stipules) and the calyx is hairy.
3. Forma γ This is the toxic form which has been collected from the Moore River (R. H. DeBurgh), Gingin (Carne and Gardner), Moora (S. Bennett) and from between Dandarragan and Jurien Bay (W. E. Blackall). It can be distinguished by its upper leaves which are long and narrow (linear), its elongated linear stipules and its glabrous calyx, or the calyx very sparsely hairy with a few long hairs. This form is toxic to cattle and sheep.

References.—Bennetts, H. W. (1935)—J. Dept. Agric. West. Aust. 12, 431. Poison Plants Committee (1934)—Coun. Sci. Ind. Res. (Aust.) Pamph. 49.

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GAS STORAGE OF APPLES

By

S. E. HARDISTY, Horticultural Adviser

As the storage life of many popular varieties of apples is limited in England by their susceptibility to low temperature breakdown, gas storage was developed as an alternative means of retarding the ripening of the fruit. Although the method does not decrease the susceptibility to low temperture breakdown, it does permit longer storage at relatively high temperatures (40 F.). It is used extensively in Great Britain and America and it also has general application for storage at 32°F.

As the store is sealed off and no fruit is removed until the end of the storage period, it is essential that only prime fruit fit for long storage is selected. It has little benefit for the short-term storage of apples.

Gas storage is a method of storing fruit in atmospheres containing a higher concentration of carbon dioxide and a lower concentration of oxygen than that present in ordinary air which contains .04 per cent. carbon dioxide and 21 per cent. oxygen. Controlled atmospheres of 5 per cent. carbon dioxide and 16 per cent. oxygen; 10 per cent. carbon dioxide and 11 per cent. oxygen and 5 per cent. carbon dioxide and 5 per cent. oxygen have been utilised.

The operation of gas stores depends upon sealing off the apples in a gas-tight chamber. As apples give off carbon dioxide in equal quantities to oxygen absorbed, there is a natural depletion of oxygen and build-up of carbon dioxide until such time as controlled ventilation is introduced. This then maintains the concentration of carbon dioxide and oxygen at the required level. A small 1in. inlet pipe with valve attached placed through the wall near the suction side of the circulating fan is an efficient means of controlling fresh air intake.

SIZE OF STORE

Due to the necessity of storing only one variety in each chamber the chamber size should not be too large and a 2,000 case capacity store has been recommended by the English workers. Wooden chambers can be made gas-tight by lining with sheet metal, leaving considerable overlap which is made gas-tight by sealing with a compound impervious to carbon dioxide. Concrete floors and brick or concrete walls can be treated with a proprietary bituminous paint. It has been suggested that the door be made gas-tight by screwing up on a rubber gasket. A single sampling point is built into the side of the chamber and is connected by a ⅜in. bore pipeline to a gas indicator which is mounted externally.

When atmospheres are required where the sum total of carbon dioxide and oxygen gases is less than 21 per cent. as with an atmosphere of 5 per cent. carbon dioxide and 5 per cent. oxygen, nitrogen has been introduced experimentally to maintain the correct ratio of gases. Another method and one which has been used commercially in England, is to allow the air of the store to be drawn by a pump through tanks of calcium or sodium hydroxide which absorbs the carbon dioxide. The air is then recirculated through the store. Control of the rate of air flow controls the amount of carbon dioxide in the store and fresh air is added to maintain the required percentage of oxygen. The strength of the absorbents in the scrubbers is 112lb. of slaked lime per 45 gallons of water, or 30lb. of caustic soda per 60 gallons of water. The cost of installing and recharging with these chemicals makes prohibitive the use of atmospheres with the sum total of carbon dioxide and oxygen being less than 21 per cent.

MAIN ADVANTAGES

The advantages of gas storage are as follows:—

(1) It increases the storage life of fruit at any given temperature by about two-thirds as compared with storage in air.

(2) The carbon dioxide specifically retards yellowing of the fruit.

(3) Loss of flavour was delayed in all varieties. Victorian experience shows that, with Democrats picked for long storage, satisfactory flavour was only produced with gas storage.

(4) Wastage by moulds and bitter pit was decreased.

English experience has shown that no more than five days (preferably less than two days) should elapse between harvesting and placing in gas storage as longer periods out of store tend to nullify the advantages of using gas storage.

The carbon dioxide content in a sealed store should reach 10 per cent. (and oxygen 11 per cent.) within six to seven days. When the apples are first placed in store they are respiring more rapidly at their initial high temperature than at the temperature they are to be stored at. Evolution of carbon dioxide is much slower once the storage temperature has been reached.

Oxygen respirators must be worn on entering gas stores as concentrations of even 5 per cent. carbon dioxide have proved injurious.

A large-scale trial in the gas storage of apples has been carried out by the Victorian Department of Agriculture (Huelin and Tindale, Victorian Journal of Agriculture, February, 1947) and a brief resume is given below:—

The storage life of apples under test was lengthened. It was generally found that colouring and softening was retarded and loss of flavour delayed in all varieties. Wastage by moulds and bitter pit was decreased but many functional disorders such as superficial scald, internal breakdown, core flush and brown heart, were increased in most varieties. An important consideration is the increase in the incidence of superficial

Table Summarising Recommended Conditions for Gas Storage.

Conditions.	Jonathan.	Granny Smith.	Democrat.
Time of picking	Early March	Mid. April	April
Ground colour at picking	Green, slight yellow	Green	
Maximum size	2½ inches	2¾ inches	2¾ inches
Temperature	36°F. until the end of April, 34°F. during May and 32°F. subsequently	31°–32°F.	31°–32°F.
Atmosphere	5 per cent. CO_2, 16 per cent. O_2	5 per cent. CO_2, 16 per cent. O_2	5 per cent. CO_2, 16 per cent. O_2

(After E. E. Huelin and G. B. Tindale.)

scald in all varieties. Even with the use of oil wraps this disorder was not completely controlled.

Of eight varieties tested, three, viz., Granny Smith, Jonathan and Democrat, proved most promising for gas storage and the attached recommendations were made.

References.

D.S.I.R.—Food Investigation Leaflet No. 6, "The Refrigerated Gas Storage of Apples," by K. Kidd and C. West.

Victorian Journal of Agriculture, Volume 45, 2. "Gas Storage of Victorian Apples," by E. E. Huelin and G. B. Tindale.

ARGENTINE ANTS

SPECIMENS of ants submitted in February by the Rockingham Health Inspector were identified as Argentine ants, these being the first recorded from this area. Two areas of infestation are present in the Rockingham townsite—one adjacent to the hotel and the other near the Fisher Street jetty. Active steps were taken by the local authorities to bring the infestation under control.

KEEN CRITICS.—Visitors to a field day in the Cowaramup area watch with interest as a Ferguson tractor demonstrates a rotary hoe for chopping up weeds and scrub growth

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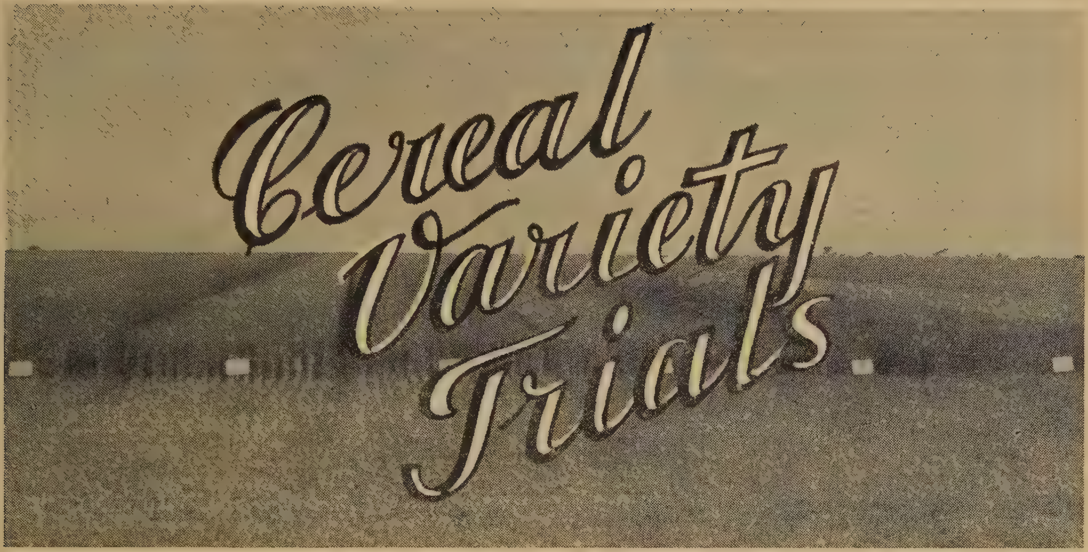

Cereal Variety Trials

Results of 1951 Trials at Research Stations

By I. THOMAS, Superintendent of Wheat Farming
and
J. REEVES, B.Sc. Agric., Agricultural Adviser

EACH year cereal variety trials are conducted on the wheatbelt research stations with the object of determining the most suitable varieties which can be recommended for planting under Western Australian conditions.

The location of the five wheatbelt research stations is such that the results obtained from trials on these stations present a reasonably overall picture for the wheatbelt and the farmer is able, by comparison with his own soil and climatic conditions, to translate the results for himself.

The rainfall figures for each of the five stations are summarised in Table No. 1.

It will be noted that rather varied conditions were experienced at the research stations this year, with only one station, Chapman, receiving normal growing period rainfall. Three stations had well below average recordings, while the remaining station, Salmon Gums, had both growing period and annual falls well above the average.

Generally the growing period rainfall was satisfactory until August, but a rather dry spring adversely affected growth and yield of crops—particularly at Merredin.

TABLE 1.

Station.	Jan.	Feb.	Mar.	Apl.	Growing Period Rainfall.							Nov.	Dec.	Annual Total.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Avondale—														
1951	12	190	....	365	70	379	146	105	33	46	779	53	160	1,559
Av. 25 yrs.	24	40	88	86	207	328	296	228	103	77	1,239	56	34	1,567
Chapman—														
1951	23	49	15	264	129	590	444	249	118	56	1,586	15	33	1,985
Av. 46 yrs.	25	37	63	78	229	418	391	263	144	88	1.533	40	25	1,801
Merredin—														
1951	50	287	11	158	67	246	140	93	30	47	623	170	156	1,455
Av. 41 yrs.	40	55	86	86	134	189	181	151	80	72	807	44	55	1,173
Salmon Gums—														
1951	323	230	81	126	173	338	98	134	343	46	1.132	53	138	2,083
Av. 26 yrs.	86	85	127	88	132	151	144	147	103	112	789	90	78	1,343
Wongan Hills—														
1951	115	63	11	220	81	284	212	124	76	19	796	34	53	1,292
Av. 26 yrs.	35	43	88	95	179	262	261	202	91	69	1,064	46	38	1,409

At Avondale, Chapman and Wongan Hills these trials were planted on land which had been under subterranean clover for a number of years and which was prepared for planting immediately prior to seeding. At Salmon Gums and Merredin the plots were planted on land which had been fallowed. Conditions at the individual stations are briefly outlined below:—

AVONDALE.—Heavy April rains and a drier May enabled planting to be carried out under favourable conditions. Finishing rains were poor and were followed by heavy falls and high winds in early December which caused damage and crop losses.

CHAPMAN.—Planting was carried out under favourable conditions until early in June when a very wet period caused waterlogging, but only light finishing rains fell in October.

MERREDIN.—Cropping operations were carried out under good conditions, but, after June, growth was retarded by cold and lack of good finishing rains in September and October. Mild conditions in October and general absence of hot drying winds enabled the crops to mature and yield better than anticipated.

SALMON GUMS.—Late summer and autumn rains caused heavy growth of weeds, however, despite this, planting took place under favourable conditions. Wet weather then set in and heavy falls in September caused the appearance, on susceptible varieties, of wheat stem rust.

WONGAN HILLS.—Good openings rains in April permitted an early start with ploughing but a comparatively dry May made seeding operations somewhat difficult. Subsequent growing period falls were considerably below average, however, despite the lack of finishing rains, crops matured well and yields were above average.

WHEAT VARIETY TRIALS

The development of wheat varieties suited to West Australian conditions has played a very important part in the extension and consolidation of the wheatbelt. New varieties produced in this State and promising new varieties from other States are included in the large scale field trials to compare them with existing varieties. In these trials the two standard varieties Bencubbin and Bungulla are used as controls—Bencubbin in the midseason and Bungulla in the early maturing variety sections respectively.

TABLE 2.

Variety.	Produced by.	Maturity.	Flag Smut Resistance.	Stem Rust Resistance.	Grain Quality.
Bungulla	W.A. Dept. of Agriculture	Very early	Highly resistant	Susceptible	State f.a.q.
Bencubbin	do.	Midseason	do.	do.	do.
Kondut	do.	Late midseason	Resistant	do.	Approaching premium strong.
Eureka	N.S.W. Dept. of Agriculture	Midseason	Moderately resistant	Now liable in W.A.	do. do.
Wongoondy	W.A. Dept of Agriculture	Early	Highly resistant	do.	do. do.
Gabo	Sydney University	do.	Susceptible	Resistant in W.A.	do. do.
Kendee	do.	Early midseason	Resistant	do.	Medium strong.
Yalta	N.S.W. Dept. of Agriculture	Midseason	Highly resistant	do.	Premium strong.
Bencubbin 48	Waite Research Institute	do.	Resistant	do.	State f.a.q.
Insignia 49	do.	Early	do.	do.	do.
Dowerin	W.A. Dept. of Agriculture	Early midseason	do.	Resistant in all States	Above State f.a.q.
Warigo	Waite Research Institute	Midseason	Highly resistant	do. do.	Medium strong.

Disease Resistance

Flag Smut.—This disease is no longer regarded as being of great importance due to the effective control given by resistant varieties. However, in the event of large areas being sown to susceptible varieties, the disease could reach epidemic proportions again.

Stem Rust.—Stem rust is composed of numerous physiological races, which differ in the varieties which they are capable of attacking. The position regarding the more important rust races in Australia has been summarised in a previous issue of this Journal (Thomas and Watson, 1950). Since then it has been definitely confirmed that, Race 126B which attacks Eureka and its derivatives such as Wongoondy, is present in this State.

A further complex of races, isolated in New South Wales in 1948 has not yet reached Western Australia. This means that varieties such as Gabo, Kendee, Yalta, Bencubbin 48 and Insignia 49, although susceptible in the Eastern States are still resistant here.

The Western Australian variety Dowerin is resistant to all these races. In addition promising new crossbreds with the same Kenya C6041 type of resistance will be included in variety trials this coming season.

Flour Strength

To meet the demand for a wheat suitable to the baking trade and to raise the general standard of Western Australian wheat, the plant breeder is concerned with the flour quality (baking strength) of his selections. Most of the recent wheat releases are an improvement in this characteristic on existing varieties which are commonly grown. It is stressed, however, as in former reports on wheat variety trials, that varieties can only express their inherent quality to the fullest when grown under suitable climatic and soil conditions. The climatic conditions cannot be altered but the farmer can influence his soil fertility by his rotational practices and by the growing of suitable legumes.

The disease resistance and baking quality of the varieties under test are summarised in Table 2 while their yielding ability is summarised in Table 3.

TABLE 3.

WHEAT VARIETY TRIALS AT RESEARCH STATIONS, 1951–52 SEASON.

	AVONDALE.			CHAPMAN.			MERREDIN.			SALMON GUMS.			WONGAN HILLS.		
	Yield.	Percentage of Control.		Yield.	Percentage of Control.		Yield.	Percentage of Control.		Yield.	Percentage of Control.		Yield.	Percentage of Control.	
		1951.	Average.		1951.	Average.		1951.	Average.		1951.	Average.		1951.	Average.
Midseason and Late Midseason Maturing Varieties for Early Planting—	bus. lb.	%	%	bus. lb.	%	%	bus. lb.	%	%	bus. lb.	%	%	bus. lb.	%	%
Bencubbin	29 7	100	100	10 51	100	100	11 46	100	100	18 46	100	100	14 40	100	100
Eureka	31 34	108	(8)108	11 20	104	(8)100	7 34	64	(7) 81	22 18	119	(8) 90	19 35	134	(7) 97
Kondut	27 29	94	(8)104	11 55	110	(8)100	7 48	66	(7) 75	16 45	89	(8) 86	17 15	118	(7) 94
Yalta	25 12	87	(4) 94	10 3	93	(5)103	8 52	75	(4) 77	18 59	101	(4) 96	15 44	103	(4) 87
Bencubbin 48....	26 0	89	....	9 28	87	....	9 28	80	....	20 58	112	....	15 20	104	....
Warigo	27 14	94	....	12 30	115	....	....	....	....	....	....	....	13 3	89	. ..
Difference for significance— P = ·05	1 18	5%	....	No significant difference			0 47	7%	....	2 3	11%	....	0 35	5%	....
Early Maturing Varieties for Late Planting—															
Bungulla	24 29	100	100	....	....	100	9 18	100	100	7 28	100	100	21 34	100	100
Gabo	28 3	115	(5)119	....	....	(5) 92	9 36	103	(6) 93	7 2	94	(5) 99	18 34	86	(5) 95
Kendee	25 15	103	(5)113	....	....	(5) 84	6 44	72	(6) 83	6 58	93	(5) 96	19 20	90	(5) 96
Dowerin	23 28	96	(5)105	....	....	(5) 86	7 12	77	(6) 85	8 22	112	(3) 95	15 7	70	(4) 84
Wongoondy	30 8	123	(6)119	....	....	(5) 95	9 8	98	(6) 96	9 23	126	(6)105	18 50	87	(6) 94
Insignia 49	....	....	....	....	....	....	8 16	89	....	10 30	141	....	18 58	88	....
Difference for significance— P = ·05	2 0	8%	....	....	....	....	1 12	13%	....	2 7	28%	....	0 43	3%	....

N.B.—Figures in brackets indicate the number of years under trial.

Discussion of Results

In the discussion of these experimental results it is desirable that they be treated on the basis of the division of the cereal growing areas into three zones. This division is on the basis of rainfall.

Zone 1 includes those districts with less than 14 in. of annual rainfall; Zone 2, those recording 14 in. to 18 in. and Zone 3 those with over 18 in.

The Merredin and Salmon Gums Research Stations are situated in Zone 1 and experimental evidence obtained from the former can be considered applicable to quite a large area of the eastern wheat belt and lower rainfall areas and from the latter for the specific conditions of the Southern Mallee.

Wongan Hills, though included in Zone 2, lies close to the boundary of Zone 1 and is typical of very large areas of light heath plain which is found in the State. The Avondale Station is typical of the west central and upper great southern districts, and Chapman for the Northern districts which lie in Zone 2.

Midseason and Late Maturing Varieties.

In this section a recent introduction, Bencubbin 48, was tested for the first time and Warigo, which was tested some years ago, was again included at several of the research stations. It will be seen from Table 3 that the yields of Bencubbin 48 were comparatively good at Salmon Gums and Wongan Hills and with Warigo at Chapman. On the other stations the yields for both these varieties were, by comparison, low but they will, however, be again included in the trials this coming season.

From the results at Merredin the variety Bencubbin is still the superior midseason variety for Zone 1 due to its ability to yield well under dry conditions. Though Bencubbin 48, which is rust-resistant in this State, yielded better than the other three midseason maturing varieties, Yalta, Eureka and Kondut, it has yet to prove equal to Bencubbin itself. In the more westerly and on the lighter types of soil of Zone 1 Yalta, Eureka and Kondut are capable of producing good yields.

In Zone 2 results from Avondale, Chapman and Wongan Hills indicate that the other midseason varieties are capable of yielding as well as Bencubbin, whilst for a number of years Eureka and Kondut at Avondale and Yalta at Chapman have yielded slightly better than Bencubbin.

None of the agricultural research stations is situated in Zone 3 but it is considered that in Zone 3 and in the higher rainfall areas in Zone 2 where, there is a high proportion of clover-ley land and, in many districts, the potential danger of a rust epidemic, strong strawed rust-resistant varieties are desirable. In these areas Kondut, though not rust-resistant, must be considered a suitable variety on account of its good straw strength, superior grain quality and potentially high yielding ability. Eureka and Yalta can also be recommended having regard to the results at Avondale and Chapman.

Early Maturing Varieties

In this section the rust-resistant variety Insignia 49 was included for the first time but, except at Salmon Gums, did not show promise. Like Insignia itself, its flour quality is no better than that of Bungulla and is definitely inferior to such varieties as Wongoondy, Gabo and Kendee.

At Salmon Gums the rust-resistant varieties have yielded satisfactorily over a period of years with Dowerin and Wongoondy returning good yields this year. The standard variety Bungulla has yielded consistently over the years and is still recommended generally for this zone. Wongoondy must now be considered rust-liable in the presence of race 126B but with its superior grain quality and strong straw is recommended as an alternative variety to Bungulla for this zone, particularly for the lighter soil types and districts where the incidence of rainfall is more favourable. Under Salmon Gums conditions rust-resistant varieties are most desirable, if not essential.

Gabo is still rust-resistant in this State and though susceptible to flag smut possesses superior grain quality and strong straw and is another useful variety, particularly where the finishing conditions tend to be somewhat above average.

In Zone 2, the trial at Chapman unfortunately had to be cancelled owing to water-logging but the progress percentages up to 1950 have been included in Table 3 for comparison purposes. It will be noted from Table 3 that Bungulla has consistently yielded somewhat better than the other varieties under test except at Avondale where all the rust-resistant varieties are at least equal if not superior to it.

The yielding ability and other desirable characteristics of Wongoondy and Gabo do, however, support their recommendation for this zone particularly as within it there are large areas of clover-ley land. Dowerin, which is early midseason in maturity must be given some consideration on account of the fact that it is resistant to all known races of stem rust in Australia and would, therefore, be a useful variety to grow in areas such as the lower Great Southern where rust epidemics are feared.

As indicated in the comments covering the midseason varieties little information is available for Zone 3 but the same general comments apply for the early as well as the later maturing varieties. Further, from the Avondale results such varieties as Wongoondy and Gabo can be confidently recommended.

In Table 4 the recommended varieties for each Zone have been listed having regard to the comment made.

TABLE 4.

Maturity Group.	Zone 1 (Early).	Zone 2 (Midseason).	Zone 3 (Late).
	Less than 14in. Annual Rainfall.	14in. to 18in. Annual Rainfall.	Over 18in. Annual Rainfall.
Midseason	Bencubbin	Kondut Bencubbin Eureka Yalta	Kondut Eureka Yalta Bencubbin
Early	Wongoondy Gabo	Wongoondy Gabo Dowerin	Wongoondy Gabo Dowerin
Very Early	Bungulla	Bungulla	Bungulla

OAT VARIETY TRIALS

The oat variety trials for grain are conducted on the wheatbelt research stations with the object of determining the most suitable varieties which can be recommended for planting under Western Australian conditions.

The trials, the results of which are set out in Table 5, are sown on a three-plot system, which enables each variety to be harvested as it matures and reduces the possibility of variation in yields due to the earlier-maturing varieties shedding before the later varieties are ready for harvesting.

TABLE 5.

Variety.	Maturity.	Grain Yield.		Per cent. of Control.	
				1951.	Average.
Wongan Hills Research Station—		bus.	lb.	%	%
Late Planted Trial:					
Ballidu	Early	36	6	100	100
Orient	Early	38	29	107	105 (2)
Wongan	Very Early	26	22	73	87 (2)
Early Planted Trial:					
Guyra	Midseason	20	37	100	100
Dale	Midseason	29	16	140	145 (2)
Algerian	Late	24	30	118	134 (2)
Merredin Research Station—					
Late Planted Trial:					
Ballidu	Early	8	2	100	100
Orient	Early	8	6	101	113 (2)
Wongan	Very Early	6	10	78	79 (2)
Salmon Gums Research Station—					
Late Planted Trial:					
Ballidu	Early	8	37	100	....
Orient	Early	12	37	144	....
Wongan	Very Early	8	11	93	....

Number of trials indicated in brackets.

These trials, consisting of a new series beginning in 1950, had to be cancelled at Salmon Gums that year, so that at that station figures are available for one season only.

For grain yields in the late planted trials, Orient, an oat released in 1947 by the Victorian Department of Agriculture, is equal to or slightly better than the West Australian variety Ballidu. Orient, of parentage Palestine x Dawn, is an early-maturing, short-strawed variety suitable for grazing and recovery for grain. The variety, Wongan, in all trials has been outyielded by Ballidu but it is a valuable variety due to its very early maturity and vigorous early growth.

In the early planted trial at Wongan Hills, Dale has given markedly superior yields to Guyra. It is capable of giving satisfactory results as a general purpose variety under a wide range of conditions. Algerian is also a useful general purpose variety, particularly in the wetter districts of the cereal-growing areas.

The recommended varieties for each Zone are listed in Table 6.

TABLE 6.

Maturity Group.	Zone 1 (Early).	Zone 2 (Midseason).	Zone 3 (Late).
	Less than 14in. Annual Rainfall.	14in. to 18in. Annual Rainfall.	Over 18in. Annual Rainfall.
Midseason and Late	Dale .... Guyra	Dale .... Guyra .... Algerian	Dale Guyra Algerian
Early	Ballidu .... Orient	Ballidu .... Orient	Ballidu Orient
Very Early	Wongan	Wongan	Wongan

BARLEY VARIETY TRIALS

The barley variety trials (for grain only) are conducted each year at one centre, Avondale, this location being considered the most suitable one for the testing of both two-row and six-row types.

The yields are set out in Table 7—

TABLE 7.

BARLEY VARIETY TRIAL FOR GRAIN, 1951–52 SEASON.

Variety.	Type.	Maturity.	Grain Yield.		Percentage of Control.	
					1951.	Average.
			bus.	lb.	%	%
Prior	2-row	Early	26	12	100	100
Research	2-row	Early Midseason	32	37	125	117 (8)
Maltworthy	2-row	Early Midseason	33	8	126	121 (8)
Atlas	6-row	Early Midseason	27	43	108	119 (8)
Beecher	6-row	Early	40	10	153	....

N.B.—Number of trials are indicated in brackets.

Description of Varieties

Prior.—Of early maturity, it is the most important malting barley grown in Australia—it is also a useful variety for green fodder purposes.

Research.—A few days later-maturing than Prior it was produced by the Victorian Department of Agriculture. It produces grain satisfactory for malting purposes.

Maltworthy.—Produced by Roseworthy Agricultural College, South Australia, it is similar to Research.

Atlas.—Introduced from California this variety is a general purpose barley being suitable for early green feed, for feed grain and for malting.

Beecher.—A smooth-awned variety, result of a cross between Atlas and Vaughan. It was introduced from America.

In this State the two-row types are used for malting and the six-row types mainly for green feed, fodder grain or for export. Over a period of years the two-row varieties Research and Maltworthy have outyielded Prior. Maltworthy is a few days later in maturing than Prior and for good quality malting grain should not be sown in the "early" zone (Zone 1.) or the drier areas of the "midseason" zone (Zone 2.).

The six-row barley Beecher in one year's trial outyielded the variety Atlas, but from grazing and recovery trials conducted on several research stations it appears as if Beecher cannot be grazed as heavily as Atlas, if satisfactory grain yields are also to be obtained.

The recommended varieties and the purpose for which they should be grown in each zone are set out in Table 8.

TABLE 8.

Use.	Zone 1 (Early).	Zone 2 (Midseason).	Zone 3 (Late).
	Less than 14 in. Annual Rainfall.	14 in. to 18 in. Annual Rainfall.	Over 18 in. Annual Rainfall.
For Malting purposes—			
Local Trade	....	Prior Research Maltworthy*	Prior Research Maltworthy
Export Trade	....	Atlas	Atlas
For Fodder Grazing and Grain	Atlas	Atlas	Atlas

* Higher Rainfall Districts only.

Acknowledgments.—Thanks are expressed to the managers and staff of the research stations for their assistance in conducting the above trials.

Drill Spacing and Rate of Seeding

Results of Research Station Experiments

By
I. THOMAS, Superintendent of Wheat Farming
and
H. G. CARISS, B.Sc.,Agric., Agricultural Adviser

DURING the war, when superphosphate was in exceptionally short supply, a wheatbelt farmer experimented with a method of sowing a crop in which he blocked each alternate drill run and in effect halved the rates of seed and super used on each acre. He expressed himself as satisfied with the results and has since continued to plant the major portion of his crop in this manner.

Although the war-caused shortage of rock phosphate has now been overcome, manufacturing difficulties and other factors have restricted the quantities of superphosphate available to individual farmers. If the new method of sowing does result in satisfactory yields it is obvious that there would be a considerable saving not only of superphosphate but of seed wheat. The superphosphate so saved could then be used to advantage for other purposes such as pasture improvement or the development of new areas of land.

It was decided, therefore, that a series of experiments would be commenced to obtain some factual evidence on the matter. During the 1951-52 season, experiments were planted at the Avondale, Chapman, Merredin, Salmon Gums and Wongan Hills Agricultural Research Stations. The experiments will be continued in the 1952-53 season.

PROCEDURE.

In designing the experiment it was decided that in addition to a comparison between the normal planting of the seed and super and the planting in alternate rows, that two other treatments should be included which had different rates of superphosphate. The treatments actually planted at each Station were:—

A. The machine was set to sow 50 lb. seed plus 112 lb. super per acre. Alternate drill runs were then blocked. Actual sowing rates, 25 lb. seed plus 56 lb. super per acre.

B. The machine set to sow 50 lb. seed plus 112 lb. super per acre. Normal planting.

C. The machine set to sow 25 lb. seed plus 56 lb. super per acre. Normal planting.

D. The machine set to sow 25 lb. seed plus 112 lb. super per acre. Normal planting.

The plots were replicated five times on a randomised block layout. The seed and fertiliser rates in treatment A are in accordance with those used by the farmer practising this treatment.

SEASONAL CONDITIONS

At all stations the seasonal conditions were variable with only one station (Chapman) approaching the normal. At all Stations the opening period was satisfactory, but the finishing period left much to be desired. Details of the rainfall and seasonal conditions at the Stations are given in the article "Cereal Variety Trials" in this issue.

Results

The yields obtained from the different sites are set out in the accompanying table.

From the table it will be noted that at each station the variety used has been one suited to the local conditions and the plots were planted as close as possible to the correct planting period for that particular variety. The actual planting and germinating dates have been included in the table as a matter of interest. The results have also been statistically analysed to determine whether or not there was any significant difference between treatments.

It will be noted from the table of results that at all stations the yields from the plots sown with alternate drill rows blocked, (Treatment A) were well below those in which the normal planting procedure had been adopted.

The fact that sowing in alternate rows might result in a saving of seed and super was not overlooked and it will be noted that in Treatment C. the same quantities (25 lb. of seed and 56 lb. of super per acre) were sown but in this case through the normally spaced drill rows, simply by setting the machine to sow these smaller quantities.

At every station but Merredin, where there was a slight margin of 38 lb. in favour of the double-spaced drill rows, (Treatment A) the yields for normal sowing (Treatment C) were in excess of those obtained by the widely spaced rows. One factor which should not be disregarded is the encouragement given to weed growth by the wider spacing. Brief comments on the individual station results are given below:—

Avondale

Treatment B, normal planting, was significantly better than any of the other treatments. Treatment C was superior to Treatment A, but C and D were not significantly different. At this Station a higher rate of seeding (60 lb. per acre) is normally used and recommended for similar conditions. It will be noted that there was no significant difference between the super rate used in C and D Treatments.

Chapman

Treatments B, C and D were all significantly better than A, but there was no difference between any of the former. At this Station, weeds, particularly wild oats, were more prevalent in the alternate row plots. The results from the different rates of super confirm previous data from other experiments, the indications at this Station are that lower seeding and fertiliser rates can be used but not in alternate rows on account of possible weed infestation.

Merredin

At this Station—normal planting. (Treatment B) was superior to all other treatments between which there was no difference. It should be noted also, that there was no significant difference between treatment A, C, and D as far as the rate of fertiliser is concerned.

Salmon Gums

The results at this Station are comparable with those at Merredin and the same comments apply.

Wongan Hills

The results at this Station where the plots were planted on clover-ley land, show that Treatments B, C and D were all superior to Treatment A, but there was no significant difference between any of the former. This latter result is particularly interesting especially with regard to the fertiliser rates per acre. The yields here confirm evidence obtained from previous superphosphate experiments that on light land, such as Wongan Hills (which has received liberal annual applications in the past), the super rate per acre can be reduced, for at least one year, without any significant reduction in yield.

From perusal of the results of this one year of the experiment it would appear that the planting of the wheat crop in alternate rows will result in reduced yields compared to the normal practice.

RATE OF SEEDING AND SPACING OF DRILL EXPERIMENT, 1951-52 SEASON

Research Station.	Avondale.			Chapman.			Merredin.			Salmon Gums.			Wongan Hills.		
Variety	Gabo			Yalta			Bencubbin			Wongoondy			Wongoondy		
Date Planted	23/5/51			19/5/51			23/5/51			26/5/51			11/6/51		
Date Germinated	2/6/51			24/5/51			5/6/51			10/6/51			21/6/51		
Treatment.—	Yield bus.	lb.	Per cent.	Yield Bus.	lb.	Per cent.	Yield Bus.	lb.	Per cent.	Yield Bus.	lb.	Per cent.	Yield Bus.	lb.	Per cent.
A—Machine set to sow 50 lb. seed and 112 lb. superphosphate per acre and alternate drill runs blocked. (Actual rates 25 lb. and 56 lb. respectively).	20	38	80	6	40	69	11	54	83	9	34	79	18	34	85
B—Machine set to sow 50 lb. seed and 112 lb. superphosphate per acre. Normal planting	25	50	100	9	36	100	14	22	100	12	22	100	21	57	100
C—Machine set to sow 25 lb. seed and 56 lb. superphosphate per acre. Normal planting	23	0	89	9	21	97	11	16	78	10	42	86	20	56	95
D—Machine set to sow 25 lb. seed and 112 lb. superphosphate per acre. Normal planting	22	4	85	9	1	94	11	58	83	10	5	82	21	25	98
Difference for Significance P = ·05	1	35	6	1	52	19	0	53	7	1	6	9	1	48	9

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NOVEL FARM-MADE SPRAY OUTFIT

By L. G. HAYWARD, Horticultural Instructor

WHEN it became apparent that their power spray unit was unable to spray all the trees in their area in accordance with the pre-arranged baiting schedule, the committee of the Eastern Hills Fruit Fly Baiting Scheme called a meeting to discuss ways and means of augmenting the service. Following upon the discussion, three of the committeemen evolved the cheap and effective spray plant described below.

A complete duplication of the power spray unit and staff was obviously not warranted and thoughts were directed towards the provision of some form of auxiliary outfit. It was recalled that at a conference of Fruit Fly Baiting Committees, Mr. R. Grist of Donnybrook, had suggested that some method of using compressed air sprays might be evolved.

Three Parkerville orchardists who are members of the Eastern Hills Committee—Messrs. C. Cappelletti, G. H. Tournay and E. Brindle—volunteered to carry out some investigations into the possibilities of a compressed air unit and as a result of their joint efforts they designed and constructed a spraying plant which has now been in use for several months and given every satisfaction.

The committee feels that a plant of this description should fulfil most of the initial requirements of future baiting schemes and points out that the principle could be adapted to operate other types of sprays, including booms for the low-pressure application of weedicides and insecticides.

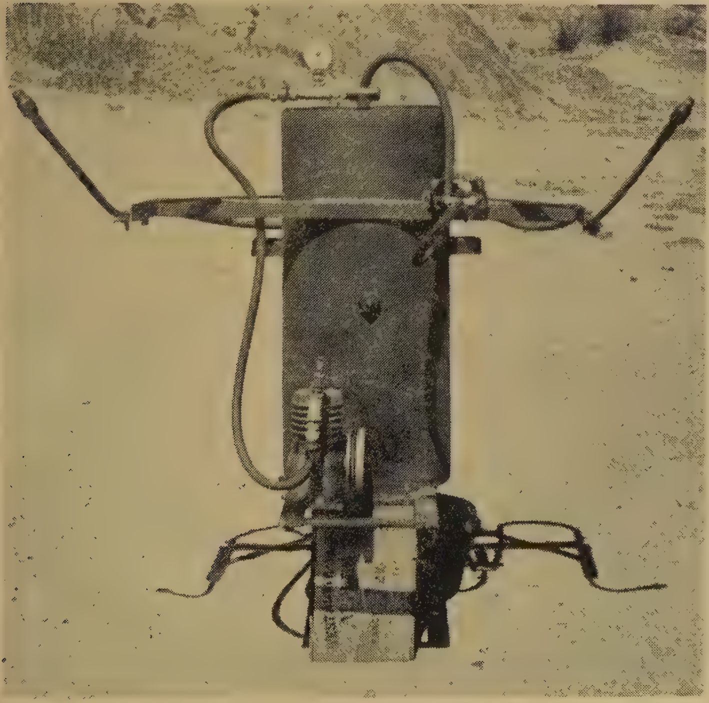


Fig. 1.—Showing the general layout of the outfit when removed from the tractor.

ADVANTAGES

This home-made plant cost approximately £100 less than the standard power spray and could be constructed by any handyman possessing a welding outfit. It weighs less than 100 lb. and may be attached to, or detached from, a tractor in one minute by one man.

When mounted on the tractor much of the weight of the spraying plant is below the axle of the machine, enabling it to be operated safely on grades which are too steep for the original power spray unit to operate on without risk.

Working at only 40 lb. pressure, the machine will throw two jets of spray a distance of 35 feet each and even with the tractor running at little more than idling speed this pressure is maintained without difficulty.

The only wearing parts in the outfit are those in the small compressor and as this is only working at 400 r.p.m. with the tractor engine running at normal speed, it should have a long life, as it is designed to work at up to 800 r.p.m.

The pressure unit is adequately safeguarded by a safety-valve, set to release if pressure goes above 40 lb. The whole of the spraying outfit is embodied in one unit so that no fittings are permanently attached to the tractor. The unit is held in position on the drawbar by two bolts and by the trunnions on the hydraulic lift arms which fit snugly into two channel sections welded to the sides of the tank. This tank holds 20 gallons of spray liquid which is adequate for the purpose for which the outfit was designed. A larger tank could be fitted if required.

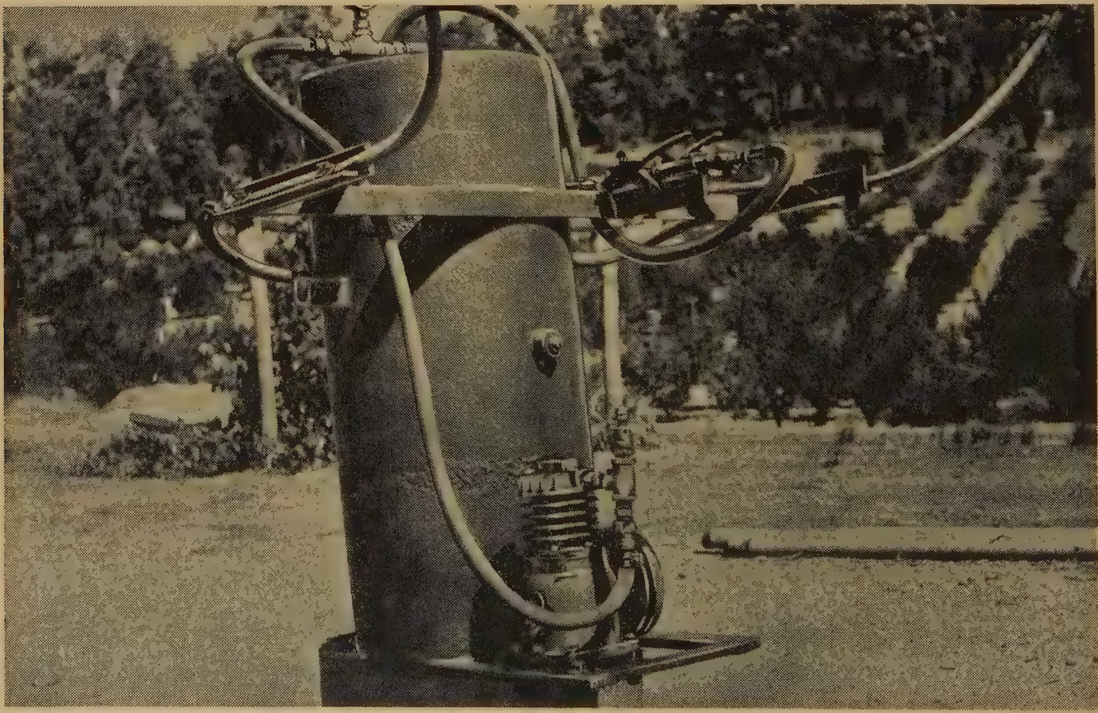


Fig. 2.—Side view showing position of compressor, pistols and nozzles. Note safety-valve on compressor T-joint.

CONSTRUCTION

The general layout of the plant is shown in Fig. 1. The spray tank and pressure tank combined is an old vaccum cylinder from a railway coach, a steel cylinder capable of withstanding a much higher pressure than the outfit exerts.

Welded to the base of the tank is a rectangular framework of 3 in. x ½ in. iron with crossbars where needed. Four holes are drilled in the frame to carry a Clisby compressor. Washers and nuts placed between the base of the compressor and the frame may be removed when necessary in order to increase the tension on the V-belt which drives the compressor. The compressor is operated by means of a 2½ in. grooved aluminium pulley fitted to the belt-pulley shaft on Mr. Cappelletti's Farmall Super A tractor. A similar grooved pulley on the compressor is 6 in. in diameter.

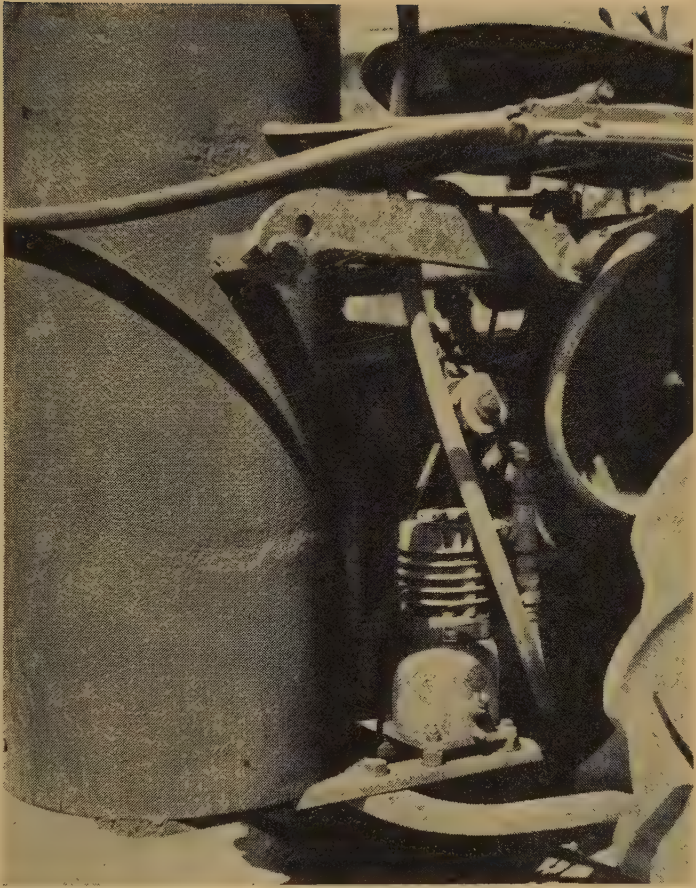


Fig. 3.—Close-up, showing method of attachment to tractor. Note nuts and washers under compressor for taking up any slack which may develop in belt.

From the compressor, to the outlet portion of which is fitted the safety valve, a length of ordinary ½ in. hose runs to an elbow fitting into a screwed plug in the centre of the top of the tank. A pressure gauge is fitted to this elbow so that the pressure may be read by the tractor operator. The screwed plug together with a similar one at the bottom of the tank (which serves as a drain plug) were fitted to the vacuum cylinder when it was constructed.

Another screwed plug socket was welded in position in the top of the cylinder about half way between the centre and the rim and a hole was drilled in the plug to carry a threaded reduction nozzle to take a ¾ in. pipe on the inside of the plug and ½ in. hose on the outside. A length of ¾ in. piping reaching to within an inch of the bottom of the cylinder was screwed to the inside of this plug and fitted with a filter made by rolling up some flywire into the shape of a cone and stuffing this into the lower end of the pipe.

About a quarter of the distance from the top to the bottom of the cylinder an angle-iron framework is welded into position to carry two Edgell spraying pistols and two spraying nozzles. The

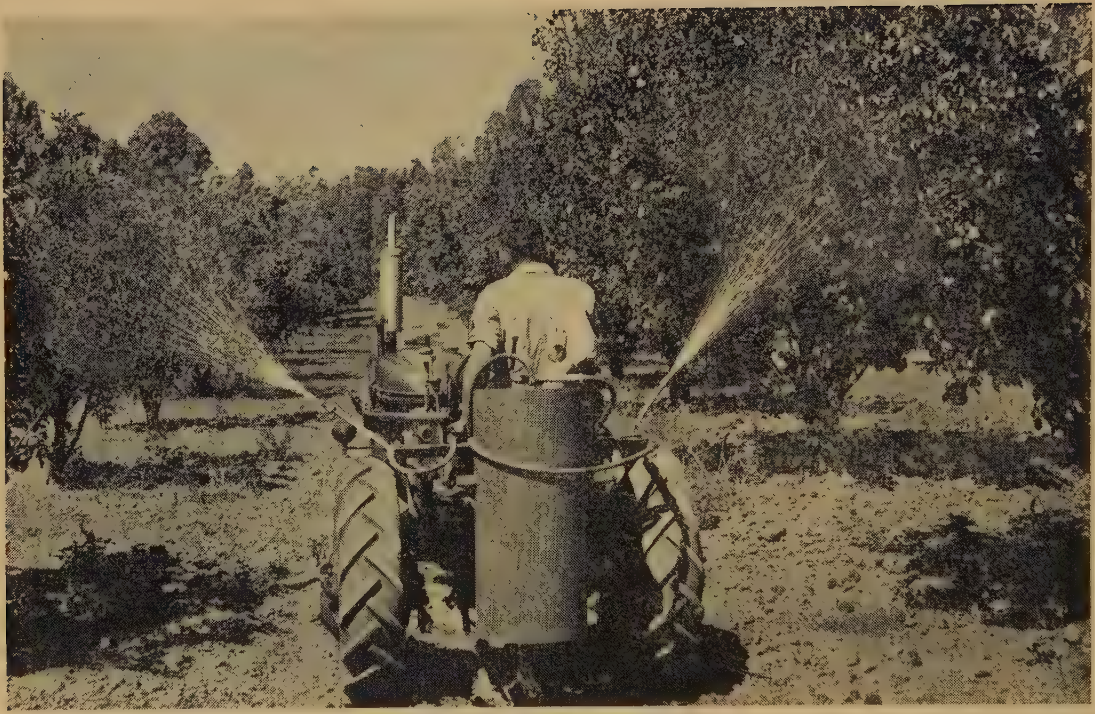
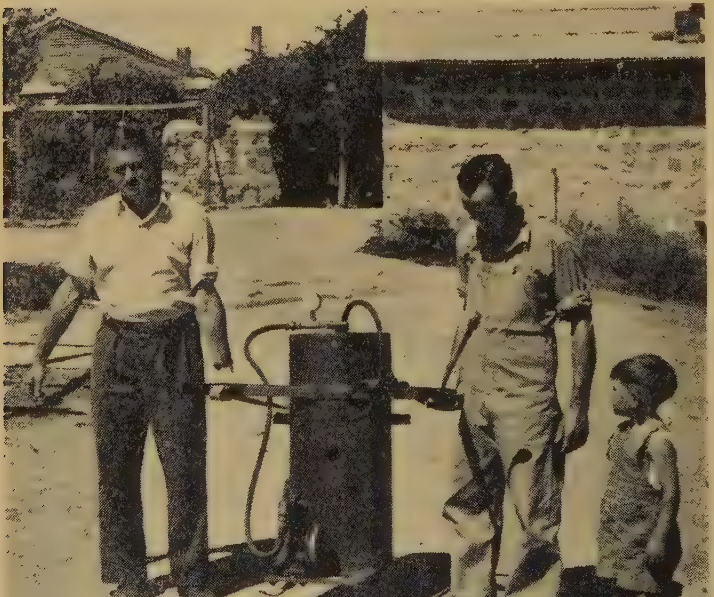


Fig. 4.—Outfit in operation in an orchard.



hose running from the screw plug runs to a forked attachment taken from a knapsack sprayer and the Edgell pistols are fitted to the two branches of the fork. Separate hoses run from the pistols to the adjustable spraying nozzles fitted on each side of the angle-iron framework.

About a third of the distance from the top of the cylinder two short lengths of channel-iron are welded to stand out horizontally from the cylinder to form sockets for the trunnions on the hydraulic lift

Fig. 5—Two men can lift the complete outfit easily.

arms. The trunnions on these arms fit down snugly into the sockets, holding the outfit firmly in position when it is secured by two bolts passing through holes in the rectangular base framework and through corresponding holes in the drawbar of the tractor.

The vacuum cylinder which forms the tank cost nothing in this case as it was obtained from a scrapheap but a suitable cylinder could be constructed from a section of steel pipe or from rolled steel plate welded into shape. The costs of other materials used are given hereunder:—

	£	s.	d.
1 Clisby Compressor	12	10	0
1 Release Valve	1	12	6
1 Pressure Gauge	1	15	0
2 Edgell Pistols	9	0	0
1 2½ in. V-Pulley	1	0	0
1 V-Belt		10	0
Hose and Fittings	1	10	0
Angle-iron, etc.		15	0
Incidentals		7	6
	£2[illegible]	[illegible]	0

The present layout is ideal for the Farmall tractor for which it was designed, but it could be adapted quite easily to other makes of machine. The 40 lb. pressure mentioned is adequate for delivering a suitable spray for fruit fly baiting, but by using high pressure hose and other fittings, it would be a simple matter to increase the pressure for more exacting spraying work.

The committee would be pleased to arrange for demonstrations of the plant or to supply any further details needed by people interested in constructing similar outfits. Inquiries should be addressed to Mr. L. G. Hayward, Chairman, Eastern Hills Fruit Fly Baiting Scheme, c/o P.O., Mundaring. W.A.

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THE SOIL ... OUR BASIC ASSET

WATER EROSION CONTROL—I

By L. C. LIGHTFOOT, B.Sc. Agric. Assistant Commissioner of Soil Conservation

ALTHOUGH soil erosion caused by water action is common in our agricultural areas, effective control measures, likely to pay for themselves quickly, can be applied in nearly every case. Plant cover above the soil surface, and fertile soil with good structure are the main factors which enable soils to resist erosion. Dense pasture gives the best cover and at the same time improves the fertility and structure of the soil both effectively and economically, so land management adjusted to the need and capability of soils, slopes, and climate is of first importance. Contour practices are of secondary value and are used where needed to support suitable farming methods, thus the care of the soil is essentially in the hands of the farmer.

The sloping lands of the jam country from Northampton to Gnowangerup have suffered badly and nearly every paddock which has been observed shows some evidence of erosion. While the areas receiving from 15 to 25 inches of rain a year have suffered most, some water erosion has occurred in the drier country right out to the 11-inch rainfall line, and the wetter areas have also been damaged. Very little of this land has been in use either for extensive grazing or for agriculture for more than 100 years, and most of it has only been cleared and cultivated within the last 40 years. In this short space of time our farmlands have probably suffered as extensively and as severely as the rather older agricultural lands of New South Wales, Victoria and South Australia.

For five years our winter rainfall has tended to be lighter than average in the areas most damaged by water erosion, and summer rainstorms have been relatively few. Although damage has extended on some areas previously eroded, partial healing has often taken place. This has been greatly helped by the rapid establishment of large areas of improved subterranean clover pastures in this period. The areas on which erosion has continued to extend are considerable, and unless controlled will constitute a challenge to the ability of their owners to continue farming them profitably. Erosion control will become uneconomic on such land unless it is applied promptly, and most of the areas on which partial healing has occurred require further attention if they are to remain safe. Above all, the management of land not yet obviously damaged must be adjusted to reduce the erosion risk as far as possible. **In the agricultural areas, water erosion has caused many times more damage than wind erosion.**

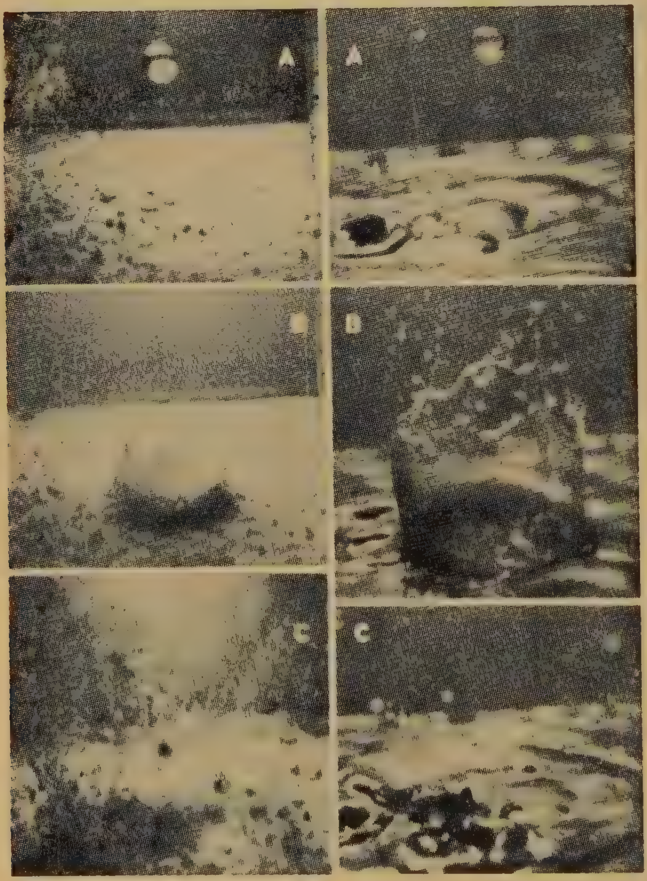

Fig. 1.—These high-speed photographs show the effect of raindrops in causing soil movement. The left-hand series shows a drop of water falling on loose powdery soil. A—Just before striking. B—Just after striking. The effect is that of a small aerial bomb. C—Four-hundredths of a second later, the air is filled with flying soil particles.

The right-hand series shows a drop of water falling on soil that is covered with a thin film of water. A—Just before striking. B—Just after striking, the water rises in the form of a cylinder. C—The cylinder collapses, leaving a turbulent wake which carried particles of soil away from their original positions.

(Photography by Edgerton, Germeshausen and Grier from "Agricultural Engineering.")

HOW DOES WATER EROSION TAKE PLACE?

Raindrop Pounding.—If rain is watched, it will be seen that each drop hits the soil surface and throws up a splash like a small bomb exploding. (See Fig. 1.) Recent investigations have shown that raindrop pounding of bare soil does two things:—

(1) It causes soil movement by raindrop splash.

(2) It slows up water absorption by the soil, either by the formation of a dense surface skin or of a pasty mass of soil and water.

On flat lands, these effects do not result in water erosion, but on sloping lands, the splash falls mostly downhill. Up to 75 per cent. of the splash falls downhill on a 10 per cent. slope. As the splash contains up to 40 per cent. of soil, raindrop pounding alone, without running water, can cause soil erosion on slopes. (See Fig. 2.)

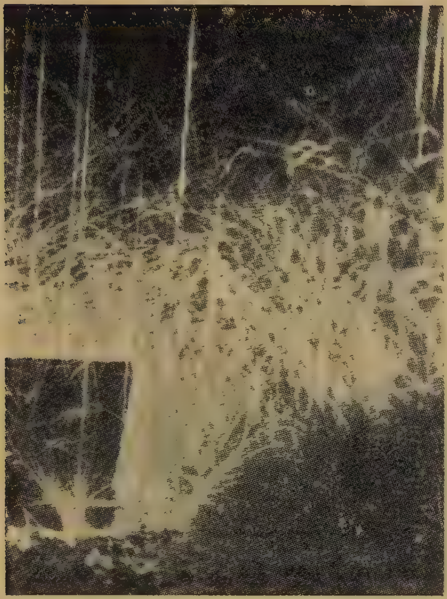

Fig. 2.—Rain falling on soil. The straight, almost vertical lines, indicate the paths of the raindrops. The mass of curves shows soil and water particles which splash from the soil surface as a result of the impact. (From "Agricultural Engineering.")

Sloping Soil and Running Water.—The surface sealing effect of raindrop action on bare soil causes much more runoff during any rains heavy enough to exceed the slower absorption capacity. Water running off sloping land carries soil particles thrown up by raindrop splash, and moves in a shallow sheet carrying a thin layer of soil. This is known as **sheet erosion,** and is very hard to detect. It is frequently the most serious form of erosion and may continue unobserved until most of the top soil has been carried away.

Running Water Tends to Concentrate and Cut.—As water moves downhill it tends to concentrate in hollows and cut small grooves known as **rills,** or deep trenches known as **gullies.** Trenches about 18 inches wide and 10 to 12 inches deep or bigger, are usually called gullies.

This knowledge of the ways in which soil erosion by water action takes place, gives a sound basis for the development of methods for controlling existing erosion and for preventing future erosion.

HOW TO CONTROL WATER EROSION

Main Needs are Surface Cover and Soil Fertility.—Investigation has shown that cover above the surface protects the soil against the bombardment by raindrops. A sufficiently dense cover prevents the raindrops from throwing up any soil in the splash as the force of all the drops is absorbed by the cover, and not by the protected soil underneath. The soil is also saved from the formation of a surface sealing skin, and can continue to absorb water at undiminished rates. In addition to absorbing water more quickly while rain is falling, the soil is also able to absorb water up to the limit of its capacity to hold it. In contrast when the sealing effect is present to a very high degree, dry soil has been found two inches below the surface after heavy rains. In addition, when rainfall intensity exceeds the maximum absorption rate of the soil, the presence of cover on the soil surface greatly slows up the rate of moving water during the run-off which must then take place.

Surface Cover.—On farm lands, surface cover is most economically provided by crops or pastures. The efficiency of plant cover in giving soil protection, depends on the density of the stand and the amount of soil left uncovered.

Living plants use great quantities of water during growth, mostly between 300 and 1,000 times the weight of the dry matter formed in the plant. If there is any tendency to excess water in the soil, living plants are desirable. But obviously cover is effective whether plants are alive or dead, **as its principal functions are to absorb the force of the falling raindrops before they hit the soil surface, and to slow up the rate of moving water when run-off occurs.**

The most efficient plant cover is provided by plants which grow densely, near the soil surface. Good pastures give a dense cover near the soil and so provide the most efficient cover on cleared land, providing grazing practices always leave enough cover to protect the soil.

This underlines the need for a different outlook when gauging carrying capacity. Some of the most serious water erosion has occurred on overgrazed pasture lands. In the long run, it is likely to be more profitable to leave some pasture to protect the soil, because when topsoil is lost, production and income decline; and when most of the topsoil is lost, productive capacity is usually impaired for a long time.

Soil Fertility. — Investigations have shown that fertile soils resist erosion best. The need to maintain and improve fertility then, is important to help protect the soil from erosion.

Dense Pastures Cover Soil and Build up Fertility.—Improved pastures whether green or dry, best meet the need

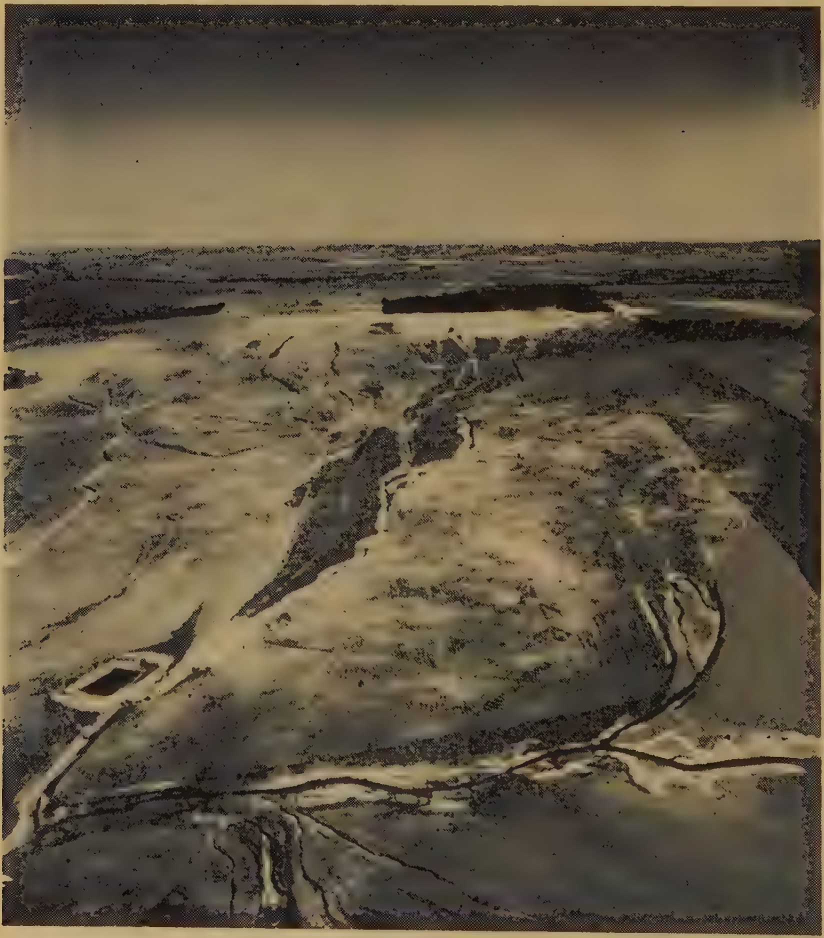

Fig. 3.—Gully erosion has already made part of this wheatbelt paddock unfit for cultivation. Some of the gullies obviously follow old cultivation lines straight downhill. The gully on the right is extending uphill and unless adequate control measures are taken the whole paddock will become uncultivable. Improved pasture would probably arrest further erosion until parts of the paddock could perhaps be protected for safe cultivation by contour banks.

—Airphoto: Kingsley Watson.

for dense cover close to the ground, providing they are not overgrazed. Legume establishment is needed to improve our pastures. Legumes such as clovers and trefoils are especially valuable for grazing on account of their high protein content, and for soil improvement because the bacteria in their root nodules are able to fix nitrogen from the air. This eventually enriches the soil when the plant is grazed or dies. Organic matter is continually added to the soil during a period of good pasture and soil structure is greatly improved.

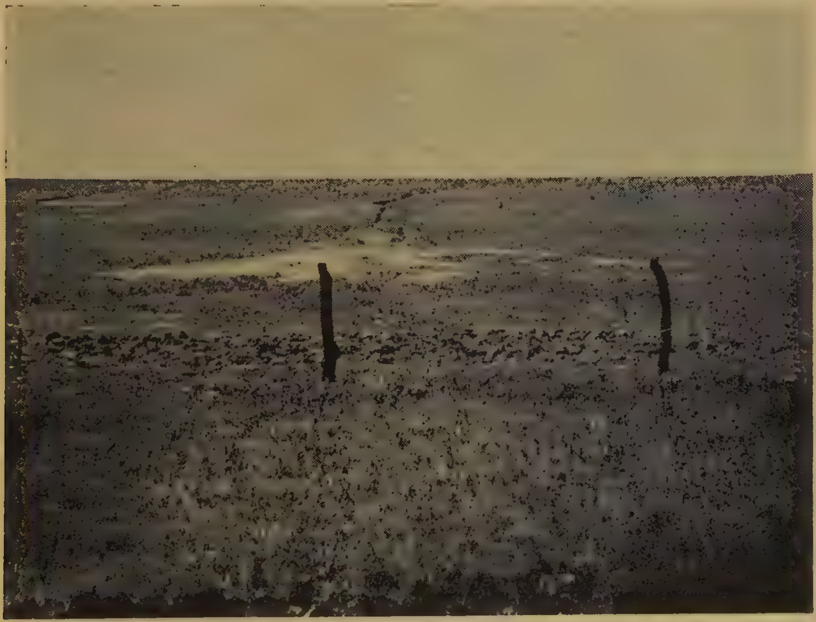

Fig. 4.—Erosion deposits in the Northam district. The lighter area above the fence posts is a deposit of soil and subsoil from the small gully above it. This gully is hardly bigger than a large rill.

Photo—Govt. Printer.

Subterranean Clover Improves Pastures.—Subterranean clover is by far the most valuable legume for improving pastures in south-western Australia. It grows well on practically all soils where there is enough rain, and on most soils of medium and light texture in the 15-25 inch rainfall zone. North of Coorow and Latham its establishment is more difficult as it needs rather more rain than for similar soils in the Central and Southern areas. The establishment of good stands of clover calls for longer pasture periods than has been the rule in wheatbelt rotations, and its introduction usually means adjusting the farm rotation by cropping smaller areas. Stock numbers should not be increased too rapidly, otherwise the clover will be eaten out before it has had sufficient opportunity to become established.

Crop Rotations.—The practice of crop rotation developed from the need to maintain and improve soil fertility and production and to spread labour. In future the suitability of any rotation to a particular area will be measured by the success of the rotation in fulfilling these needs while at the same time preventing soil erosion.

Periods of pasture are desirable on all soils and in all types of mixed farming. Numerous experiments and the ex-

perience of farmers generally, in Australia and overseas, have shown that the most effective and economical method of improving soil fertility is by the inclusion of a pasture period in the rotation. (See Figs 5 and 6.)

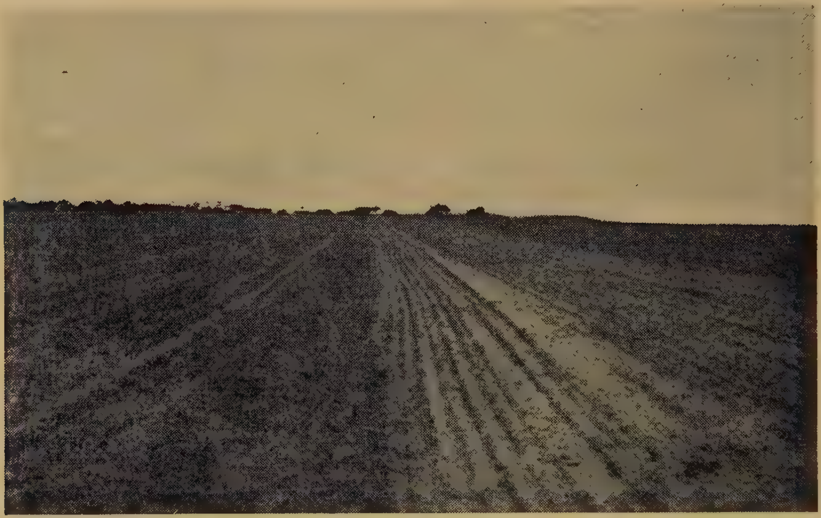

Fig. 5.—Light land at Wongan Hills sown to clover 1941, except the light coloured strip. The clover was ploughed and seeded to wheat in autumn 1947, and yielded better than 30 bushels an acre. In 1948 wheat was again seeded. Note better crop and darker soil where five years of clover pasture has added organic matter to the soil. Photo taken on 23rd June, 1948.

—Photo G. H. Burvill.

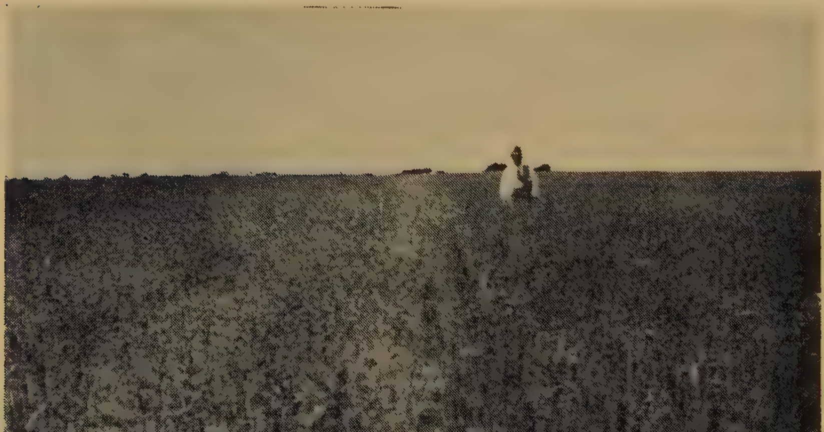

Fig. 6.—Photo taken October, 1948, on same strip as in A, but on the other side. Estimated wheat crop on old clover land at right, 21 bushels, and where clover not seeded, seven bushels an acre. This land was also under wheat in 1947.

—Photo G. H. Burvill.

Clover often takes from three to five years to become firmly established, but the adoption of heavy rates of seeding (up to 10 to 20 lb. per acre) by farmers who are gathering their own seed, has given good stands in one year. Naturally, the development of good stands takes longer on soils exhausted of fertility by overcropping or erosion.

Clover Disease.—There have been difficulties associated with the breeding of sheep grazed on pastures dominated by the Dwalganup strain of subterranean clover used in the wheatbelt. The Department of Agriculture has continued to advise farmers to keep on planting more Dwalganup clover because of its outstanding value in building soil fertility resulting in higher yields. (See Figs. 5 and 6.) Slower-maturing varieties such as Yarloop, Bacchus Marsh and Midseason (Mt. Barker), are grown in districts with longer growing seasons and more rain. The sheep breeding difficulties have been largely overcome by providing winter grazing of true grasses and cereals instead of nearly pure clover pastures.

Other Legumes Needed.—Clover does not meet all needs for increased carrying capacity and soil protection and improvement in these areas. The Western Australian blue lupin is also a valuable legume for these purposes. Barrel clover and burr trefoil are useful where they do well, mostly on soils of medium and heavy texture. Peas are grown to a minor extent. The search for other legumes is proceding actively and a vetch *(Vicia eurillia)* now named Malta, has given promising results on the Departmental Research Stations. As legumes respond particularly to phosphorus, continued topdressing with phosphates greatly encourages the legume plants in pastures.

Subterranean Clover Pre-eminent for Soil Conservation.—But subterranean clover is more adaptable to most situations than these other legumes. Perhaps the most important immediate aim of the Soil Conservation Service is to encourage the establishment of clover wherever soil and climate permit.

Surface Cover on Very Poor Soils.—Cereal rye is useful for establishing cover on areas where other crops and pastures have failed as it will make moderate growth on exhausted, deficient and eroded soils. It has made good cover on steep eroded slopes and is likely to assist establishment of subterranean clover or lupins in such cases. Seeding at 30 to 50 lb. with superphosphate at 80 to 100 lb. an acre is recommended for cereal rye.

DEEPER ROOTING PLANTS FOR SOIL CONSERVATION

Sub clover and ryegrass are rather shallow rooted plants while cereals are deep-rooted where soil conditions permit. Deep-rooting plants in our pastures could perform valuable functions particularly in the wetter areas where cereals are used less frequently in the rotation. After surface and subsoil drainage has taken place, water held in the soil is used for plant growth or is lost by evaporation. Excepting soils which crack deeply as they dry, little soil moisture is evaporated from deeper than two or three feet below the surface. **Use by plant roots is the only way of removing water held in the soil after drainage and evaporation have removed all they can. Deep-rooting plants serve to dry out the soil, partially or fully, to a greater depth.** This has several valuable results:—

(1) The soil can absorb more of the total rain which falls on it, with a consequent decrease in run-off. This reduces the erosion hazard.

(2) The soil reserves of soil moisture available for plant growth are increased if roots can reach them, giving the possibility of greater production and a longer growing season.

(3) The feeding area of plant roots is increased. This also gives the possibility of greater production and in pasture plants, has a value in concentrating plant nutrients from the deeper soil layers in the topsoil where most plant roots normally develop.

Working the Land*.—Fallowing as practiced in Western Australia leaves the soil bare for many months and greatly increases the erosion hazard on sloping lands. A rough, cloddy surface absorbs water better and resists erosion better than a fine mulch. Soils on which good subterranean clover pastures grow, will in most cases produce cereal crops without a period of bare fallow. Many sloping lands will need contour working on contour banks if they are to be fallowed safely.

ADJUST LAND MANAGEMENT FIRST

The following practices comprise a logical and economic programme for controlling and preventing soil erosion by water action:—

(1) The use of legumes, mainly sub-clover, for improving pastures.
(2) The use of improved pastures to cover the soil and improve its fertility and structure.
(3) The adjustment of grazing to always maintain better plant cover.
(4) Longer rotation to include several years improved pasture between arable crops.
(5) Avoiding bare fallow wherever possible.
(6) Reducing cultivation to the minimum necessary to kill most weeds and prepare a seed bed. This will leave the surface as rough and cloddy as possible consistent with these purposes.
(7) Use of the new weedicides will further reduce the need for cultivation.

These practices develop and maintain a dense plant cover for the longest possible period in rotations. They make and keep the soil surface more absorptive so that it lets rainwater in more quickly and there is less run-off. They make soil erosion less likely when run-off does occur and they maintain fertility.

All these practices can be put into effect by the farmer—in fact they are an integral part of sound farming technique, and serve to emphasise the statement made earlier in this article that "the care of the soil is essentially in the hands of the farmer."

In the next issue of the Journal it is proposed to discuss the use of contour practices as an aid to the basic control measures outlined above.

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* See G. H. Burvill, "Changing Ideas in Soil Conservation," "Journal of Department of Agriculture, W.A.," Vol. 22, March, 1945, pp. 3-10, reprinted as Leaflet 809.

RIFLE AMMUNITION

THE Minister for Agriculture (Sir Charles Latham) recently discussed the question of supplies of 0.303 and 0.310 ammunition with the Federal Minister for Supply as the Agriculture Protection Board is anxious that farmers should obtain adequate supplies of ammunition for the control of vermin.

It was stated that all military stocks of 0.310 ammunition have been distributed and that all available 0.303 ammunition is urgently required for defence purposes. No more ammunition of these types can be released at present but arrangements are being made for the importation of supplies of both types from England.

The Composition of the Dwalganup Strain of Subterranean Clover

By A. B. BECK*

(From Animal Health and Nutrition Laboratory, Department of Agriculture and the Government Chemical Laboratories, Western Australia)

SUBTERRANEAN clover is now the major pasture species in Western Australia and according to Elliott (1948) nearly 90 per cent. of the sown pastures of this State have a subterranean-clover base or were originally sown with this species. In spite of its great economic importance, no data have been published showing the chemical composition of the clover growing in this State. In order to fill this gap in our knowledge, series of samples of the Dwalganup strain were collected from three localities. These have been analysed by the Government Chemical Laboratories and the results are presented in this paper.

The samples collected were of leaf and petiole only and the analyses have been done by standard methods. The results are presented in Table 1. The figures for "crude protein" are calculated on the basis of 6.25 times the nitrogen content and the "crude fat" is a petroleum ether extract.

DISCUSSION

The results set out in Table 1 show trends similar to those found in all pasture species. The percentage protein content which is high in the young plants, falls slowly until the beginniing of seeding when the level drops rapidly. Part of this apparent loss of protein is due to dilution by carbohydrate material synthesised by the plant but probably the major loss is due to a transfer of protein to the seeds which are not included in the samples analysed. No samples of seed were collected from the experimental areas, but a sample of cleaned commercial "Dwalganup" seed has been analysed. The results, together with some figures recorded by Shapter (1935) and Franklin and Powning (1942) are given in Table 2.

The crude fibre changes are also similar to those of other pasture species. There is generally a slow rise during growth with a sharp increase as the plant begins to dry off. The Kojonup samples (Series 3) are rather unusual in that there was no apparent change in crude fibre content between June and September.

The samples of dried leaf and petiole all show a rather high content of crude fibre but the protein content is sufficiently high to make this material a valuable feeding-stuff. The additional value of the seed is to be taken into account when considering these figures.

The total ash figures do not show any obvious trends but in all cases the phosphorus levels decline steadily during growth and the calcium content increases, at least up to the wilting stage. Beck (1938) has noted similar increases in the calcium content of capeweed throughout the growing period. Figures for the zinc, copper and manganese content of subterranean clover are given by Teakle and Turton (1943) but it is probable that many of the samples were of the "Midseason" (Mt. Barker) strain. A few figures for the copper content of "Dwalganup" samples are given by Beck (1951).

In considering the analytical figures as indicators of the feeding value of subterranean clover, it should be remembered that the Dwalganup strain has certain properties which make it different from most other pasture species. Together with other clover strains it is relatively unpalatable in the early stages of growth and throughout the growing period contains appreciable amounts of an oestrogenic substance. Because of its unpalatability there is a tendency for it to become the dominant species of the pasture. If other species are present in small amounts only and sheep are thus forced to consume a high proportion of clover, serious breeding abnormalities will occur as described by Bennetts, Underwood and Shier (1946). It is probable that sheep grazing on a Dwalganup clover pasture containing a good proportion of grass will only begin to eat appreciable amounts of the clover from flowering time onward. For this reason the later analytical figures are the ones which have most significance from the viewpoint of animal nutrition. The clover is oestrogenic from flowering up to the wilting, at which stage the activity becomes extremely low (Braden 1950). It is unlikely however that sheep grazing on a well-balanced clover pasture will show any untoward effects in this period, as the presence of adequate grass in the pasture will "dilute" the clover and the period of oestrogenic stimulation is probably too short to cause any trouble. Cattle do not seem to show any ill effects from grazing green clover.

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* C.S.I.R.O. Senior Research Officer, stationed at the Department of Agriculture, Animal Health and Nutrition Laboratory, Nedlands, Western Australia.

The importance of subterranean clover lies not only in its feeding value but also in the increase of the nitrogen status of soils when the pasture is grazed by animals. This makes it possible to establish in the second phase of pasture development good stands of grasses or cereals which are palatable and non-oestrogenic throughout the growing period.

ACKNOWLEDGMENTS

The writer wishes to acknowledge his indebtedness to Mr. R. C. Rossiter, of the Division of Plant Industry, C.S.I.R.O. for making arrangements for the collection of the Nedlands and Kojonup samples, to the staff of the Avondale Research Station for the collection of the Beverley samples and to the Government Chemical Laboratories for the carrying out of the analyses recorded in this paper.

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Table 1.

COMPOSITION OF SUBTERRANEAN CLOVER, DWALGANUP STRAIN.

(All figures given as percentage on a moisture-free basis.)

SERIES 1.—INSTITUTE OF AGRICULTURE, NEDLANDS, 1947.

	May 29.	June 27.	July 29.	Aug. 28	Sept. 29.	Oct. 28.	Nov. 13.	Nov. 29.	Dec. 28.
Crude protein	26·1	26·7	23·1	19·2	14·3	13·9	9·7	11·3	11·5
Crude fibre	11·1	12·9	15·1	16·8	19·1	18·2	24·9	30·6	37·5
Crude fat	3·4	2·7	2·6	5·2	2·3	3·2	2·8	1·7	1·6
N-free extractives	49·9	46·4	50·3	50·7	54·6	54·5	52·8	48·8	43·5
Total ash	9·5	11·3	8·9	8·1	9·7	10·2	9·8	7·6	5·9
Calcium (Ca)	1·45	1·56	1·19	1·45	2·04	2·69	3·50	2·66	1·86
Phosphorus (P)	0·27	0·30	0·27	0·21	0·15	0·13	0·10	0·09	0·09

Germination began on April 20th. Flowering on July 25th. Sample of November 13th mostly dry: Completely dry on November 29th. *Soil type*:—grey sand.

Table 1—*continued.*

COMPOSITION OF SUBTERRANEAN CLOVER, DWALGANUP STRAIN—continued.

SERIES 2: BEVERLEY, 1948.

	Aug. 10.	Aug. 25.	Sept. 28.	Oct. 21.	Dec. 12.
Crude protein	28·9	27·4	22·9	13·2	10·0
Crude fibre	12·4	14·3	17·8	21·4	34·4
Crude fat	2·7	2·6	1·6	1·9	1·3
N-free extractives	47·2	47·4	48·5	52·5	48·3
Total ash	8·8	8·3	9·2	11·0	6·0
Calcium (Ca)	0·96	0·88	1·11	1·7	1·46
Phosphorus (P)	0·25	0·22	0·15	0·08	0·04

Germination rain on June 5th, but growth very slow on account of cold weather.

No flowering August 25th, full flower September 28th, wilting October 21st, completely dry December 12th.

Soil type—brown sandy loam.

SERIES 3—" GLEN LOSSIE " C.S.I.R.O. FIELD STATION, KOJONUP, 1950.

	June 23.	July 20.	Aug. 18.	Sept. 1	Dec. 1.
Crude protein	27·8	26·7	23·1	24·1	15·1
Crude fibre	12·0	11·8	12·5	11·8	29·4
Crude fat	2·3	3·4	2·5	2·1	1·6
Total ash	13·1	10·6	9·6	9·1	11·1
N-free extractives	44·8	47·5	52·3	52·9	42·8
Calcium (Ca)	1·22	1·25	1·54	1·43	1·59
Phosphorus (P)	0·32	0·29	0·25	0·22	0·16

Germination rain on May 8th: flowering commenced Aug. 12th: Wilting at end of October.

Soil type.—gravelly sand.

Table 2.

COMPOSITION OF THE SEED OF SUBTERRANEAN CLOVER.

(All figures given as percentage on a moisture-free basis.)

Sample.	Crude Protein.	Crude Fat.	Crude Fibre.	N-free extract.	Total Ash.	Ca.	P.
W.A. Commercial (Dwalganup Strain)	28·1	17·3	8·3	42·2	4·1	0·16	0·55
Franklin and Powning (1942) (Dwalganup Strain)	41·6	....	....	....	....	0·17	0·77
Franklin and Powning (1942) (Dwalganup Strain)	38·7	....	....	....	....	0·18	0·73
Shapter (1935) (Strain not given)	39·6	15·2	9·0	31·6	4·6	....	0·72

BEES
and
HONEY

PREPARING BEESWAX FOR MARKET

By R. S. COLEMAN, Government Apiculturist

BEESWAX is an extremely valuable commercial product in these days, and no apiarist can afford to neglect this important by-product of the honey industry. Apart from the large quantities needed within the industry for the manufacture of foundation comb, beeswax has a wide variety of industrial uses. It is an important component of polishes and is widely used as a waterproofing agent and in the insulating of delicate electrical equipment.

The beekeeper anxious to produce clean bright beeswax needs simple equipment which need not be costly but he must keep in mind two basic principles.

The first of these is that the wax must not come into contact with any metal surfaces unless they are well-tinned or zinc-galvanised. Contact with iron, whether rusty or bright, gives the wax an irremovable dirty brown colour.

The second cardinal rule is that beeswax should be cooled very slowly after melting. If possible the wax should be kept in a molten condition for 12 hours. This will allow the dross to settle completely and give a clean block of wax.

The beekeeper gathers wax from three main sources, the cappings reducer, from the rendering down of old combs and from the salvaging of burr comb but the first-named source yields by far the greatest quantity.

Wax from cappings needs very little preparation but does benefit from suitable treatment before being sold. Melt the wax in water in a heavily-tinned container of a size suitable to the quantities of wax which have to be handled. Use rainwater if possible to keep the wax floating free of the bottom of the container and as a safety measure keep a bucket of cold water handy to pour into the wax if it shows signs of boiling over. If rainwater is not available care should be taken not to use water containing alkali. Beeswax is slightly acid in reaction and alkaline water may cause a spongy mass to form on the bottom of the blocks of wax. Frothing of the wax will denote over-heating, and over-heating for long periods is apt to spoil the colour and consistency. The level of the wax may be regulated by adding or removing water. Heat over a slow fire until the wax melts freely then keep the wax molten as long as possible over a small banked fire. This allows ample time for dross to sink to the bottom or rise to the top and the clean wax may then be drawn off into tapered moulds. Smearing honey over inside surfaces of the moulds will prevent the wax from adhering tightly when cold.

A WAX REFINER

The following method of making a simple wax refiner was described in the Agricultural Gazette of N.S.W. (See Fig. 1.)

Obtain a 44-gallon drum of the heavy galvanised type, and remove the top with a cold chisel.

In the side of the drum, about two inches from the bottom, cut a hole to take a piece of one-inch galvanised piping about 11 inches in length. This is threaded at both ends and has a 90 degree elbow screwed on each threaded portion. Fit the rose of a watering-can to the elbow inside the drum and to the other elbow attach a piece of one-inch pipe about 33 inches long, terminating in a funnel.

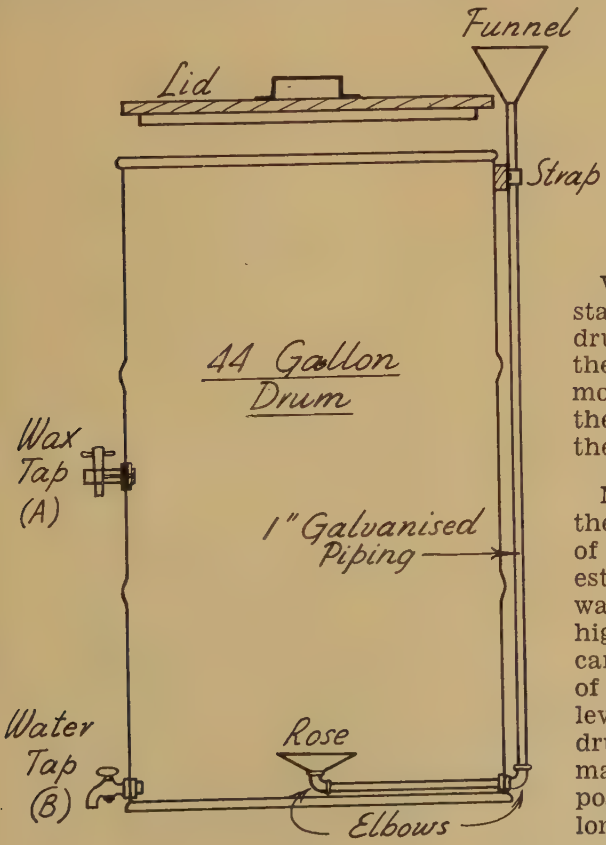

Fig. 1.

Secure the long piece of piping by riveting and soldering a strap over the pipe about two inches from the top of the drum. Solder round the hole where the pipe passes through the drum in order to make it watertight at this point.

Fit a small low-pressure water tap near the bottom of the drum, and about 17 inches from the top of the drum fit a small honey-gate or similar type of tap. These, of course, should be soldered or fitted into position with suitable back-nuts. Make a wooden lid to cover the drum.

To use the refiner, fill the drum with water to the level of the wax tap (A). Heat over a small fire until the water boils and then draw portion of the fire so that the water does not boil furiously. Add the wax from the cappings reducer, or blocks of wax which require further refining, and stir regularly until all the wax is melted.

When all the wax is in a liquid state, withdraw the fire and allow the drum to stand for five minutes then skim the surface with a piece of gauze to remove any foreign matter lighter than the wax such as dead bees, chips from the frames, etc.

Next test the wax level by opening the wax tap and allowing a few ounces of the content to run out. If you have estimated your wax level correctly the wax will run out but if the water is too high, water or slumgum will issue. This can be rectified by running water out of the lower tap (B) until the correct level is obtained. Place the lid on the drum and cover with bags or similar material to conserve as much heat as possible for as long as possible. The longer the cooling period the more complete will be the sedimentation process and the cleaner will be the sample of beeswax obtained.

The wax should be run off when a film commences to appear on the surface around the edge of the drum.

When the wax has been run into suitable moulds the moulds should be placed where they can cool slowly. If placed on cold concrete floors or in a cool draught of air the beeswax cools too quickly and contracts in the process, resulting in unsightly cracks appearing in the wax instead of the blocks merely shrinking away from the moulds.

When the wax stops running from the honey gate or wax tap slowly add boiling water through the funnel. This will build up the level and allow the wax to flow again. Continue to add water slowly at intervals until slumgum appears at the wax tap. The tap should be closed at this stage and the drum and contents allowed to cool. A thin layer of wax will remain on the surface of the water but this may be salvaged and treated again when larger quantities of wax have to be refined.

OLD COMBS

When salvaging wax from old combs, carefully remove all bee-wires as these are apt to discolour the wax. Soak the combs for 24 hours as this prevents the cocoons and larval casts, etc., in the combs from absorbing large quantities of wax which could not be forced out by the press. The wax is then melted down in a little water over a slow fire.

There are many methods of removing wax from old combs but the wax press is easily the most efficient. When using a press, hessian is placed in the press and the molten comb is then poured into the hessian which is folded over to form an envelope. Pressure is then applied until the wax stops running, the plate is screwed back, the hessian envelope opened and more molten comb is poured in. After two or three pressings, instead of pouring in more comb, boiling water is poured into the hessian envelope and pressure applied once more. This is repeated until only the slumgum remains in the envelope together with a negligible quantity of wax.

Where a press is not available the small beekeeper often melts down the comb and strains it through fly-wire but this leads to considerable wastage and is not recommended. A better method is to place the soaked comb in a hessian bag which is then boiled in a drum with a wooden grate between the bag and the bottom of the drum to prevent the bag from charring. Pressure is applied to the bag in order to squeeze out the wax which will float to the top of the water and may be removed when cold. Even this method wastes much

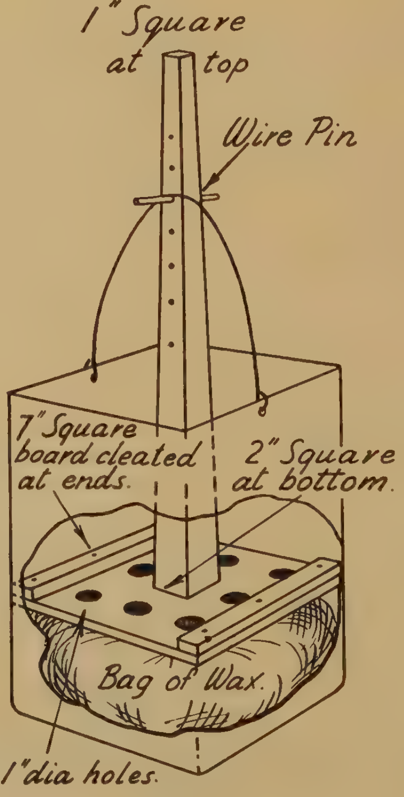

Fig. 2.

valuable wax, however, and for the small beekeeper I would recommend a device which I think was invented by Mr. L. R. Thomas of Ravensthorpe and subsequently described in "The Western Mail." (See Fig. 2.)

A seven-inch square board is cleated at the ends to prevent splitting and has a number of one-inch holes bored in it. A 30-inch length of 2 in. x 2 in. timber is then tapered so that the top end finishes about one inch square. This timber, which forms the handle, is screwed firmly to the square board and a number of small holes three inches apart are bored at intervals near the narrow end of the handle. This completes the pressure portion of the wax extractor.

To operate, cut away the top half of a sugar bag and stuff the lower half with old combs, cappings, pieces of wax, etc. Sew across the mouth of the bag very tightly, using a bag needle and twine, then place the bag of wax into a kerosene bucket to boil. The bucket should be a new one that is well-tinned. Insert the wooden pressure portion in the bucket and secure it by passing the wire pin through the lowest hole in order to keep the bag of wax below the surface of the water. As the wax melts, press the bag further down by altering the position of the wire pin but do not press the bag so far down that it touches the bottom of the tin. Reduce the fire when the water boils and allow the mixture to simmer gently for about ten minutes. Lift from the fire and push the pressure stick down to its limit. Allow to rise slowly then press it down slowly about half a dozen times never lifting it more than about three inches. Finally press it down hard to the bottom of the tin flattening the bag of slumgum as much as possible and pass the wire pin through the highest possible hole in the handle so that it will be held in this position.

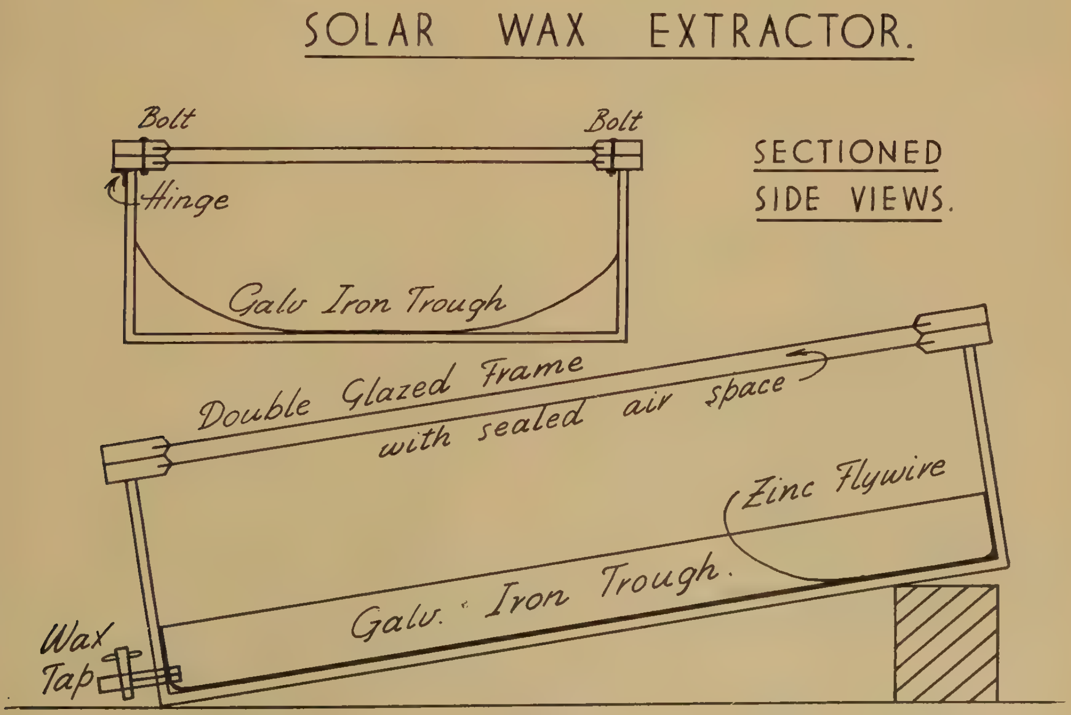

Fig. 3.

If this is done as recommended all the wax will now be floating on top of the water. Add boiling water until the bucket is more than three-quarters full then put it aside and allow to cool slowly.

At the end of the cooling period you will have a clean block of beeswax which will have set around the handle. A light tap will remove the handle leaving the block of wax with a square hole in the centre.

BURR COMB

The third source of saleable beeswax comes from the rendering down of burr comb. It is surprising what a large quantity of wax can be saved over a year by carrying a tin on the barrow and, after examining a hive, throwing the burr comb into the tin instead of tossing it away to become a breeding spot for wax moth.

This burr comb is best treated in a solar wax extractor. (See Fig. 3.) Primarily, this is a wooden box with a galvanised iron trough in the bottom and a glazed frame over the top, preferably two thicknesses of glass with a slide or space between them. The box is placed on a slant facing the sun and the wax is thrown on the top of the slope, usually over a sheet of perforated zinc or zinc-coated fly-wire to serve as a strainer. When melted by the sun the wax runs into a container at the bottom of the box. The temperature in a solar wax extractor reaches well over a 150 degrees F. and even when the shade temperature is not much over 70 degrees F., very high temperatures will be registered inside the extractor.

Another advantage of the solar wax extractor is that the wax is bleached as it runs down the slope, producing a light coloured product which brings high returns.

The best return for any product is received when it is marketed in an attractive form and beeswax is no exception. The small amount of trouble taken in making the wax attractive will be amply rewarded by increased prices.

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BEES IN BOX HIVES

A Simple Transfer Method

By A. KESSELL, Junior Technician, Apicultural Branch

THE keeping of bees in other than properly appointed hives with standard frames is illegal in Western Australia as such hives make it almost impossible to inspect the swarms in order to check for disease. Nevertheless, beekeepers occasionally encounter swarms which have established themselves or have been established in fruit cases or other types of boxes or containers.

To transfer the bees to standard hives, smoke the box fairly heavily and move it to a position about six feet to one side of its original site. On the vacated site place a standard hive containing one or two drawn combs on one side.

Stand the box on its end and remove the bottom boards, after cutting free any comb which may be attached to them. Now tip the box until the combs are roughly vertical and smoke the bees heavily so that they move to the top of the box. Many will fly back to their old stand and enter the standard hive while the remainder will cluster on and between the combs at the top of the box.

Now carry the box to the hive and with a swift jerk throw the cluster of bees into the hive. With most of the bees out of the box, rip off one side, cut out the combs and brush the rest of the bees into the hive. During the whole of the transfer operation keep a look out for the queen bee and if she can be found place her in the frame hive to hold the bees there.

Put any comb containing honey into a basin for attention later, and cut the brood combs to such a size that they will fit into standard frames. Place these sections of brood comb into frames and tie in position with string, crossing the strings on the inside edges of the top and bottom bars. Place these frames immediately in the frame hive where the bees will fix the comb in the frame and eventually chew away the strings. These combs will not be wired of course, and after a brood has hatched should be removed as they will not stand much handling.

The combs containing honey may be melted in a cappings reducing or cleaned up by the bees in the hive. To do this place a queen excluder on top of the frames and cover it with a sheet of paper which is smaller than the excluder by about one inch all round. Dump the broken comb on top of the paper and place an empty super round it and then replace the lid.

In about three weeks the bees will have cleaned out all the honey and stored it below leaving the wax behind. This method stops any robbing and the honey is not damaged by heat.

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FERTILISERS

The following Fertilisers have been registered at the Department of Agriculture under the Fertilisers Act 1928, for the year commencing 1st November, 1951.

Name of Fertiliser.	Reg. No.	Brand.	By Whom Registered.	Nitrogen (N) as				Phosphoric Acid (P_2O_5) as				Potash (K_2O) as		Cash Price per ton at Works (W) or on Rails Perth (P).
				Nitrate.	Ammonia.	Blood and Bone.	Bone Dust.	Water Sol.	Citrate Sol.	Acid Sol.	Total.	Sulphate.	Muriate.	
A.—MINERAL.														
1.—NITROGENOUS.														
(a) Nitrogen as Nitrate.														
Sodium Nitrate	7	Fauldings	F. H. Fauldins & Co. Ltd.	16·0	....	....	....	....	....	....	....	....	....	£5/12/0 per cwt.
Chilean Nitrate of Soda	69	Champion	R. Dundas Smith & Son	16·0	....	....	....	....	....	....	....	....	....	
(b) Nitrogen as Ammonia.														
Ammonium Nitrate	8	Fauldings	F. H. Faulding & Co. Ltd.		30·0	....	....	....	....	....	....	....	....	£6/1/4 per cwt.
Sulphate of Ammonia	9	do.	do. do. do.		20·0	....	....	....	....	....	....	....	....	£1/16/- per cwt.
Sulphate of Ammonia	11	I.C.I.A.N.Z.	Cuming Smith & Mt Lyell F.F. Ltd.		20·5	....	....	....	....	....	....	....	....	£34/17/- (W)—P £36/5/7 (W)—G £35/10/3 (W)—B
Sulphate of Ammonia	46	Cresco	Cresco Fertilisers (W.A.) Ltd.		20·5	....	....	....	....	....	....	....	....	£34/17/- (W)
Sulphate of Ammonia	84	David Gray's	David Gray & Co. Ltd.		21·0	....	....	....	....	....	....	....	....	1/10½ per 2lb. bag. 2/6 per 7lb. bag.
2.—PHOSPHATIC.														
(a) Rock Phosphate.														
Ground Rock Phosphate....	12	C.S.M.L.	Cuming Smith & Mt Lyell F.F. Ltd.	....	....	....	....	....	....	36·6	36·6	....	....	£13/10/11 (W)
Do. do.	13	Sickle	do. do. do.	....	....	....	....	....	....	36·6	36·6	....	....	£13/10/11 (W)
(b) Superphosphate.														
Superphosphate 22%	14	C.S.M.L.	Cuming Smith & Mt. Lyell F.F. Ltd.	....	....	....	....	18·0	2·0	2·0	22·0	....	....	£14/10/6 (W)
Do. do.	15	Mount Lyell as ML in diamond	do. do. do.	....	....	....	....	18·0	2·0	2·0	22·0	....	....	£14/10/6 (W)
Do. do.	16	Sickle	do. do. do.	....	....	....	....	18·0	2·0	2·0	22·0	....	....	£14/10/6 (W)
Do. do.	47	Cresco	Cresco Fertilisers (W.A.) Ltd.	....	....	....	....	18·0	2·0	2·0	22·0	....	....	£14/10/6 (W)
(c) Superphosphate and Minors.														
Super and Copper Ore No. 2	17	C.S.M.L.	Cuming Smith & Mt. Lyell F.F. Ltd.	....	....	Copper 1·0	....	15·0	1·5	1·5	18·0	....	....	£16/9/8 (W)
Super and Manganese	18	do.	do. do. do.	....	....	....	Manganese 3·8	15·0	1·75	1·75	18·5	....	....	£22/7/9 (W)
Super and Zinc	19	do.	do. do. do.	....	Zinc 2·5	....	....	17·0	1·75	1·75	20·5	....	....	£15/17/8 (W)
Super and Zinc No. 2	20	do.	do. do. do.	....	1·15	....	....	17·5	1·75	2·0	21·25	....	....	£16/3/11 (W)
Super, Copper Ore and Zinc	21	do.	do. do. do.	....	1·15	1·0	....	14·5	1·5	1·5	17·5	....	....	£17/5/7 (W)
Super and Copper Ore No. 2	22	Sickle	do. do. do.	....	....	1·0	....	15·0	1·5	1·5	18·0	....	....	£16/9/8 (W)
Super and Manganese	23	do.	do. do. do.	....	....	....	3·8	15·0	1·75	1·75	18·5	....	....	£22/7/9 (W)
Super and Zinc No. 2	24	do.	do. do. do.	....	1·15	....	....	17·5	1·75	2·0	21·25	....	....	£16/3/11 (W)
Super, Copper Ore and Zinc	25	do.	do. do. do.	....	1·15	1·0	....	14·5	1·5	1·5	17·5	....	....	£17/5/7 (W)
Super and Copper Sulphate	48	Cresco	Cresco Fertilisers (W.A.) Ltd.	....	....	1·25	....	17·0	1·75	1·75	20·5	....	....	£20/2/2 (W)
Super and Copper Ore No. 2	49	do.	do. do. do.	....	....	1·0	....	15·0	1·5	1·5	18·0	....	....	£16/9/8 (W)
Super and Zinc Oxide No. 2	50	do.	do. do. do.	....	1·15	....	....	17·5	1·75	2·0	21·25	....	....	£16/3/11 (W)

Super, Copper Ore and Zinc Oxide	51	do.	do. do. do.	....	1·5	1·0	....	14·5	1·5	1·5	17·5	....	....	£17/5/7 (W)
Super and Manganese	52	do.	do. do. do.	....	....	....	3·8	15·0	1·75	1·75	18·5	....	....	£24/4/8 (W)
Super and Molebdenum	53	do.	do. do. do.	Molybdenum Trace	....	....	....	18·0	2·0	2·0	22·0	....	....	
Super and Minor Elements	54	do.	do. do. do.	....	3·0	1·0	3·0	13·0	1·5	1·5	16·0	....	....	£23/13/1 (W)
Super and Copper No. 1	94	C.S.M.L.	Cuming Smith & Mt. Lyell F.F. Ltd.	....	....	Copper 1·25	....	17·0	1·75	1·75	20·5	....	....	£21/16/6 (W)—G
Super, Copper Sulphate and Zinc	95	C.S.M.L.	do. do. do.	....	Zinc 1·25	1·25	....	16·5	1·75	1·75	20·0	....	....	£22/12/4 (W)—G
3.—POTASSIC.														
(*a*) *Potash as Sulphate.*														
Sulphate of Potash	55	Cresco	Cresco Fertilisers (W.A.) Ltd.	....	....	....	....	....	....	....	....	48·0	....	£40/19/10 (W)
(*b*) *Potash as Muriate.*														
Muriate of Potash	26	Sun	Cuming Smith & Mt. Lyell F.F. Ltd.	....	....	....	....	....	....	....	....	....	58·0	£33/11/3 (W)
Do. do.	56	Cresco	Cresco Fertilisers (W.A.) Ltd.	....	....	....	....	....	....	....	....	....	59·0	£33/11/3 (W)
4.—NITROGEN AND PHOSPHORIC ACID.														
Potato Manure "C"	27	C.S.M.L.	Cuming Smith & Mt. Lyell F.F. Ltd.	....	3·5	....	....	14·5	1·5	1·5	17·5	....	....	£20/8/4 (W)—G £20/5/8 (W)—Pn
Do. do.	28	Mount Lyell as ML in diamond	do. do. do.	....	3·5	....	....	14·5	1·5	1·5	17·5	....	....	£20/3/4 (W)
Do. do.	29	Sickle	do. do. do.	....	3·5	....	....	14·5	1·5	1·5	17·5	....	....	£20/3/4 (W)
Do. do.	57	Cresco	Cresco Fertilisers (W.A). Ltd.	....	3·5	....	....	14·5	1·5	1·5	17·5	....	....	£20/3/4 (W)
Lawn Manure	71	Dawn	W. E. Sheffield	....	8·54	....	....	9·23	1·36	0·82	11·4	....	....	21/5 per doz. pkts. (5lb.) wholesale.
5.—NITROGEN, PHOSPHORIC ACID AND POTASH.														
Potato Manure "A"	30	C.S.M.L.	Cuming Smith & Mt. Lyell F.F. Ltd.	....	2·5	....	....	14·0	1·5	1·5	17·0	....	5·00	£21/1/4 (W)—Pn £21/3/4 (W)—G
Potato Manure "A2"	31	do.	do. do. do.	....	2·5	....	....	13·5	1·5	1·5	16·5	5·0	....	£22/9/7 (W)
Potato Manure "B"	32	do.	do. do. do.	....	3·5	....	....	13·0	1·25	1·25	15·5	....	5·0	£22/5/3 (W)
Potato Manure "E"	33	do.	do. do. do.	....	3·5	....	....	12·0	1·25	1·25	14·5	....	8·0	£23/9/2 (W)
Potato Manure "E2"	34	do.	do. do. do.	....	3·5	....	....	11·5	1·25	1·25	14·0	8·0	....	£25/12/1 (W)
Orchard Manure	35	do.	do. do. do.	....	3·5	....	....	13·0	1·25	1·25	15·5	....	5·0	£22/5/3 (W)
Tomato Manure	36	do.	do. do. do.	....	3·5	....	....	10·5	1·25	1·25	13·0	10·0	....	£27/0/1 (W)
Tobacco Fertiliser	37	do.	do. do. do.	....	3·3	....	....	12·0	1·25	1·25	14·5	5·7	....	£23/15/3 (W)
Potato Manure "A"	38	Mount Lyell as ML in diamond	do. do. do.	....	2·5	....	....	14·0	1·5	1·5	17·0	....	5·0	£20/19/8 (W)
Potato Manure "B"	39	do.	do. do. do.	....	3·5	....	....	13·0	1·25	1·25	15·5	....	5·0	£22/2/11 (W)
Potato Manure "E"	40	do.	do. do. do.	....	3·5	....	....	12·0	1·25	1·25	14·5	....	8·0	£23/6/10 (W)
Orchard Manure	41	do.	do. do. do.	....	3·5	....	....	13·0	1·25	1·25	15·5	....	5·0	£22/2/11 (W)
Potato Manure "A"	42	Sickle	do. do. do.	....	2·5	....	....	14·0	1·5	1·5	17·0	....	5·0	£20/19/8 (W)
Potato Manure "B"	43	do.	do. do. do.	....	3·5	....	....	13·0	1·25	1·25	15·5	....	5·0	£22/2/11 (W)
Potato Manure "E"	44	do.	do. do. do.	....	3·5	....	....	12·0	1·25	1·25	14·5	....	8·0	£23/6/10 (W)
Orchard Manure	45	do.	do. do. do.	....	3·5	....	....	13·0	1·25	1·25	15·5	....	5·0	£22/2/11 (W)
Potato Manure "A"	58	Cresco	Cresco Fertilisers (W.A.) Ltd.	....	2·5	....	....	14·0	1·5	1·5	17·0	5·0	....	£20/19/8 (W)
Potato Manure "B"	59	do.	do. do. do.	....	3·5	....	....	13·0	1·25	1·25	15·5	5·0	....	£22/2/11 (W)
Potato Manure "E"	60	do.	do. do. do.	....	3·5	....	....	12·0	1·25	1·25	14·5	8·0	....	£23/6/10 (W)
Orchard Manure	61	do.	do. do. do.	....	3·5	....	....	13·0	1·25	1·25	15·5	5·0	....	£22/2/11 (W)
Rose Manure	72	Dawn	W. E. Sheffield	....	5·9	....	....	10·3	1·52	0·91	12·7	....	1·64	21/5 per doz. pkts. (5lb.) Wholesale.
Bulb and Corm Manure	73	do.	do. do.	....	1·9	....	....	9·2	1·4	0·8	11·4	....	9·0	21/5 per doz. pkts. (5lb.) Wholesale.
Seedling Manure	74	do.	do. do.	....	5·3	....	....	8·75	1·25	1·0	11·0	....	4·4	21/5 per doz. pkts. (5lb.) Wholesale.

FERTILISERS—*continued.*

Name of Fertiliser.	Reg. No.	Brand.	By Whom Registered.	Nitrogen (N) as				Phosphoric Acid (P_2O_5) as				Potash (K_2O) as		Cash Price per ton at Works (W) or on Rails Perth (P).
				Nitrate.	Ammonia.	Blood and Bone.	Bone Dust.	Water Sol.	Citrate Sol.	Acid Sol.	Total.	Sulphate.	Muriate.	
6.—MISCELLANEOUS.														
Growth Fertiliser Tablets	6	Summit	L. M. McLeod	....	4·1	....	....	7·0	1·2	0·1	8·3	12·2	....	
Liquid Manure	10	Fauldings	F. H. Faulding & Co. Ltd.	....	7·5	....	....	5·0	....	....	5·0	3·5*		
Tablet Fertiliser	70	Gard-n-tabs	G. C. Warner Laboratories Pty. Ltd.	14·0		....	....	38·0	....	....	....	24·0*		
Plant Food	75	Dawn	W. E. Sheffield	....	5·23	Minor Elements. Zinc Magnesium Copper Manganese		11·21	1·41	1·46	14·08	....	trace	21/5 per doz. pkts. (5lb.)Wholesale.
Garden Fertiliser	83	Bests	S. H. Best & Son	....	3·0	....	....	10·0	1·2	1·0	12·2	5·0		
Liquid Fertiliser	85	David Gray's	David Gray & Co. Ltd.	9·0		....	....	6·0	....	....	....	4·0*	....	19/3 per gallon tin.
Powdered Fertiliser	86	do.	do. do. do.	....	5·6	....	....	3·89	....	1·94	5·93	....	3·2	3/7 per 7lb. bag.
Rose Manure	87	do.	do. do. do.	.. ..	5·6	....	....	3·89	....	1·94	5·93	....	3·2	3/6 per 7 lb. bag. 37/6 per 112 lb. bag
"Hi-Grow" No. 1	88	Hi-Grow	E. G. Inman	....	22·0	....	....	1·0	....	....	1·0	....	1·0	14/6 per gal.
Hypon 2	93	Hypon	Hydroponics Pty. Ltd.	....	4·0	....	....	5·0	....	....	5·0	....	4·0	3/- per 20 oz. bottle
Liquid Fertiliser	96	Blue Peter	Agricultural Products Company	....	7·5	....	....	5·3	....	....	5·3	....	3·7	
B.—ORGANIC.														
(a) *Blood and Bone.*														
Animal Fertiliser	1	K in diamond A & A Surprise West Aus.	C. A. Kirkby & Sons	....	....	5·0	....	....	4·0	10·0	14·0	....	....	£24/7/0 (P)
Blood and Bone	2	T B & S in diamond	Thomas Borthwick & Sons (Aust.) Ltd.	....	....	5·75	....	....	6·75	5·25	12·0	....	....	£16/10/0 (W)
Do. do.	3	Wyndham....	Wyndham Freezing, Canning & Meat Export Works	....	....	6·0	....	....	6·5	9·0	15·5	....	....	£23/2/0 (P).
Animal Fertiliser	5	State Abattoir Midland Junction	State Abattoir, Midland Junction	....	....	8·0	....	....	....	....	5·0	....	....	£18/0/0 (W)
5% N Blood and Bone	63	Thomas	W. Thomas & Co. (W.A.) Ltd.	....	....	5·0	....	....	3·0	9·0	12·0	....	....	£26/0/0 (P).
Blood and Bone Manure....	64	Kitchens....	J. Kitchen & Sons Pty. Ltd.	....	....	7·0	....	....	9·0	5·0	14·0	....	....	
Blood and Bone Fertiliser	65	Blue Cross	Agricultural Products Co.	....	....	5·0	....	....	....	....	13·0	....	....	2/11½ per 7lb. bag. 1/11½ per 4lb. bag.
Animal Fertiliser	66	do.	do. do. do.	....	....	3·75	....	....	....	....	15·0	....	....	2/11½ per 7lb. bag. 1/11½ per 4lb. bag.
B.B. Fertiliser	78	Wooltana	Westralian Farmers Co-op. Ltd.	....	....	4·0	....	....	....	....	9·15	....	....	£24/10/0 (P)
Animal Fertiliser	79	do.	do. do. do.	....	....	4·0	....	....	....	....	9·15	....	....	£24/10/0 (P)
No. 1 Fertiliser	80	do.	do. do. do.	....	....	3·0	....	....	....	....	13·0	....	....	£20/15/0 (P)
Blood and Bone	89	Eclipse	The West Australian Meat Export Works	....	....	6·0	....	....	....	....	12·0	....	....	£22/0/0 (W)
Do. do.	91	Apex	E. J. Fry Pty., Ltd.	....	....	5·0	....	....	....	....	13·0	....	....	£30/13/4 (W)
(b) *Bone Fertiliser.*														
Bone Meal	68	Fall's	Anthony Heslop	....	....	....	3·5	....	....	....	22·2	....	....	£17/0/0 (P)

(c) *Fish Fertiliser.*														
Fish Fertiliser	4	Cormo	Nor-West Fertilisers	....	....	5·0	....	....	....	....	8·0	....	....	
Crameal	82	Wesfarmers	Westralian Farmers Co-op. Ltd.	....	....	6·0	....	....	....	1·25	1·25	....	....	£26/15/0 (P)
(d) *Miscellaneous.*														
Liquid Whale Fertiliser....	62	Thomas	W. Thomas & Co. (W.A.) Ltd.	....	....	6·25	....	....	....	....	....	....	....	£33/0/0 (P)
Special Garden Fertiliser	67	Blue Cross	Agricultural Products Co.	5·75		....	....	....	....	....	16·5	....	1·5	
No. 1	76	Superhumus	W. E. Sheffield	....	2·0	....	....	1·8	0·5	0·2	2·5	....	2·0	16/6 per doz. pkts. (4.lb.) Wholesale
No. 2	77	do.	do. do.	....	4·0	....	....	3·0	0·5	6·5	10·0	....	0·5	16/6 per doz. pkts. (4 lb.) Wholesale
No. 2 Fertiliser	81	Wooltana	Westralian Farmers Co-op. Ltd.	2·0		....	....	2·0	....	9·0	11·0	....	....	£21/0/0 (P)
No. 1 Fertiliser	90	Apex	E. J. Fry Pty Ltd.....	5·0		....	....	....	....	....	9·0	....	....	£25/0/0 (W)
Fertiliser	92	Sprout-em	Kag Manufacturing Co.	....	....	....	2·75	....	5·0	4·0	9·0	....	....	
Rose-bush Fertiliser	97	Blue Cross	Agricultural Products Co.	....	5·0	....	....	4·5	1·5	1·75	7·75	....	3·0	

P—denotes Perth. G—denotes Geraldton. B—denotes Bunbury. Pn—denotes Picton * Potash as Nitrate.

N.B.—Prices shown on above list were those given at the time of registration, and are not necessarily those obtaining today.

COBALT

Its Use to Control "Wasting Disease"

By L. C. SNOOK, B.Sc. (Agric.), D.Sc., Animal Nutrition Officer

COBALT is one of the most interesting of the so-called "trace" elements. Particularly is this so to West Australians as the use of cobalt has permitted farmers to rear healthy sheep and cattle where previously this was impossible. Also, it was in this State that Filmer and Underwood carried out much of the fundamental work which led to the discovery of the vital importance of cobalt.

Minute traces of cobalt are essential in the diets of ruminants, that is in the food of animals which chew their cud. Only about one part of cobalt in every ten million parts of dry matter is present in average herbage but this seemingly insignificant trace MUST be present, otherwise sheep and cattle will waste away and eventually die. Strangely enough, non-ruminants do not need cobalt. Horses and rabbits, for example, will flourish on cobalt-deficient pastures where sheep and cattle are dying. Apparently, cud chewing animals need cobalt because this element is used by organisms which live in the rumen or paunch. These organisms seemingly build up certain nutrients vital to the welfare of sheep and cattle.

DENMARK WASTING DISEASE

Cobalt deficiency caused serious losses among dairy cattle in Western Australia when the coastal areas of the South-West were developed as Group Settlements after World War I. "Denmark Wasting Disease," as it was called, resembled "Bush-sickness" which had caused similar losses in New Zealand and which was then assumed to be due to iron deficiency as it was cured by feeding an iron ore called limonite.

Tests showed that limonite would cure Denmark Wasting Disease also, but Filmer (1932) deduced that it was not iron which was needed by the animal but something present along with the iron. Subsequent work by Filmer and Underwood (1935, 1936) clearly demonstrated that the cobalt present in limonite was the curative principle.

Limonite is still used as a cheap practical source of cobalt to prevent "Wasting Disease" but pure cobalt salts are equally effective and, when available, can be cheaper.

AREAS WHERE COBALT DEFICIENCY OCCURS

As far as we know, in this State cobalt deficiency is almost entirely restricted to the coastal areas, specifically to coastal country consisting of sand and limestone. Heavy clays and rich loams grow pasture containing adequate cobalt. Where alluvial silt has been deposited along creeks and estuaries cobalt deficiency is not a problem. The karri soils of the South-West appear to be an exception. In spite of their rich appearance and loamy texture the pasture growing in karri country can be seriously lacking in cobalt. The cobalt status of some of the South-West jarrah-red gum country is also low.

Cobalt is not a plant food. This means that excellent pastures can be grown on soils deficient in cobalt. As occurred when "Wasting Disease" was a serious problem in the Denmark area, cattle and sheep could waste away in paddocks containing an abundance of green herbage of apparently excellent quality.

SYMPTOMS OF COBALT DEFICIENCY

Sheep and cattle receiving inadequate amounts of cobalt develop "Wasting Disease." This is an excellent descriptive name because, in the absence of cobalt, ruminants lose their appetite and waste away. Affected animals become weaker, develop "weepy" eyes, and if not treated will die within three months to two years after symptoms are first noted. Both sheep and cattle often become anaemic.

Symptoms become apparent at any time of the year but are most obvious in the spring and early summer when green feed is abundant. Milk production in dairy cows is seriously reduced and sterility is common. Where deficiency is only marginal, the animals may only appear unthrifty, that is, they will become lean, develop harsh dull coats, and give the appearance of suffering from internal parasites. This unthriftiness may only be obvious among young stock in areas where the adult animals seem to obtain sufficient cobalt for their needs.

This has been illustrated during the last two years where breeding ewes have been taken into coastal areas by dairy farmers. The ewes remained in good health but the lambs were weak at birth, developed "weepy" eyes, and lost the desire to suckle the ewes. The administration of cobalt solution per medium of a spoon quickly restored the appetite, followed by complete recovery.

Filmer and Underwood (1936) in their original paper, give the following hints to assist in determining whether a disease characterised by loss of condition is "Wasting Disease":—

1. Wasting disease occurs in the presence of ample feed, and is most common when the feed is green.
2. Horses are never affected with wasting disease.
3. Young cattle, especially those between six and 18 months, are more susceptible to wasting disease than mature cattle.
4. Sheep, and lambs especially, are more susceptible to wasting disease than young cattle.

By analysing the livers of suspected animals lack of cobalt in the diet can be determined. As very little cobalt is present in a normal liver, however, special care has to be taken to avoid contamination with foreign material when collecting livers for investigation.

"COAST DISEASE"

This is due to a dual deficiency of cobalt and copper. It occurs typically on the fine coastal sands and limestones developed from windblown shell. Light land further inland ("banksia sands") can also be affected.

Animals affected with "coastiness" generally die of "wasting disease" due to lack of cobalt before there is time for gross symptoms of copper deficiency to develop.

TREATMENT

Limonite Licks.—Selected iron ore (limonite) containing at least 500 parts per million of cobalt is still used as a cheap and convenient source of cobalt for stock. Limonite is the major ingredient of Denmark Lick.

The original Denmark Lick contained linseed meal and di-calcic phosphate along with salt, limonite and bluestone. These ingredients together made a palatable, general purpose lick.

For reasons of economy, however, the Denmark Lick now sold has been made more specific. It consists of two-thirds common salt and one third limonite plus copper sulphate. If sheep consume one ounce of this lick each week, or cattle one ounce a day any deficiency of cobalt or copper should be corrected.

The method of supplying this lick to stock will vary with circumstances. It may be placed in boxes or troughs in the field, so long as the lick is protected from rain. Sheep are generally fond of salty mixtures and will eat enough lick to satisfy their needs. In coastal areas, however, sheep sometimes ignore salt licks so the stock-owner must never neglect to make sure that enough lick is consumed by ALL the animals needing it. Particularly is supervision necessary where cattle are concerned. The mere placing of Denmark Lick in boxes is no guarantee that "Wasting Disease" will be prevented. The medicine has to be taken.

With dairy cows it is preferable to mix the lick with the feed given in the bails. Each cow then necessarily consumes the recommended amount.

At the present time (January, 1952) Denmark Lick costs £12 5s. a ton (ton lots) f.o.r. at the superphosphate works. The average dairy farmer will only need about four or five bags each year so that any likelihood of cobalt deficiency can be eliminated at a trifling cost.

If the farmer wishes to make up his own lick he can purchase limonite from the superphosphate manufacturers at about 25s. per bag of 180 lb. Where freight charges are heavy and stock salt is available on the property, the purchase of the ground limonite may be a worthwhile economy. The limonite can also be mixed with boneflour or bonemeal where this is fed to cattle. One ounce of limonite a day will be ample for three cows or thirty grown sheep.

Cobalt Salts.—Until 1951, commercial cobalt chloride could be purchased for as little as 10s. a pound. This provided a cheap and convenient source of cobalt for the farmer, one ounce containing about as much cobalt as is present in 100 lb. of Denmark Lick. Unfortunately, cheap cobalt salts are no longer available. This means that the farmer must necessarily use limonite as the source of the cobalt needed by sheep and cattle in coastal areas. Should cobalt chloride become available, however, it can be used to make salt licks or be added to the drinking water.

To prepare a salt lick one ounce of cobalt chloride should be mixed with each 100 lb. of common salt. This lick can then be used in the same manner as Denmark Lick. Generally it is most convenient to dissolve the weighed amount of cobalt chloride in water so that this can be sprinkled over the salt before mixing.

Where bonemeal or boneflour is being fed to cattle, the cobalt chloride may be mixed with this supplement. Alternatively cobalt solutions can be prepared for sprinkling on to meadow hay.

On certain pastoral properties on the North-West coast, the lack of cobalt and copper in the herbage has been corrected by adding the salts to the drinking water. One ounce of cobalt chloride will suffice to treat the water consumed by a thousand sheep in one week. In the absence of cobalt salts, pastoralists will necessarily have to use limonite licks. By including 4 ozs. of bluestone in every 100 lb. of lick a compound cobalt-copper lick can be prepared for use in "coasty" country.

SUPPLYING COBALT THROUGH THE PASTURE

In some countries, cobalt salts are added to the soil with the fertilizer. Although cobalt is not needed by the plant, sufficient is absorbed to supply the needs of the grazing animal.

This method of prevention is not recommended in this State, however, chiefly because of the difficulty in obtaining cheap water soluble cobalt salts. It has also been shown (Rossiter *et al.* 1948) that less than 1 per cent of the cobalt used in the fertilizer is recovered in two years by the grazing animal. It seems much more efficient to feed the cobalt direct to the animals which need it.

SUMMARY

"Wasting Disease" in ruminants is due to lack of cobalt in the diet.

In Western Australia pastures deficient in cobalt are known only in the coastal areas.

Cobalt deficiency may be corrected by feeding limonite licks, by use of cobalt salts in the feed or drinking water, or by the application of cobalt salts to the soil.

Under present conditions the feeding of limonite is the cheapest and most practical method of correction.

Limonite mixed with salt is sold ready for use as a stock lick under the name of Denmark Lick.

REFERENCES

J. F. Filmer (1933), Aust. Vet. J., *9*, 163.

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R. C. Rossiter, D. H. Curnow and E. J. Underwood (1948), J. Aust. Inst. Agric. Sci., *14*, 9.

E. J. Underwood and J. F. Filmer (1935), Aust. Vet. J., *11*, 84.

GRADE HERD RECORDING

Increase in Fees

THE Superintendent of Dairying (Mr. M. Cullity) has announced that from March 1, 1952, onward, dairy farmers whose herds are included in the Grade Herd Recording scheme will be asked to pay a fee of 5s. per cow, instead of 3s. 6d.

The increase in fees has been made necessary because of the steadily rising costs of the scheme. Since 1946 the South-West basic wage had risen from £4 19s. 7d. to £10 4s. 7d. and other costs had risen accordingly. Mr. Cullity pointed out that even at 5s. per cow, the farmer is paying less than one third of the total cost of the scheme, the balance of the expenditure being carried in almost equal proportions by the State and Commonwealth Governments. The cost of the State Government's contributions has risen from £2,826 in 1946-7 to £6,936 in 1950-1.

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The FARM
BOOK SHELF

Some Reviews of Current Publications of Rural Interest

FRUIT PRESERVATION

WITHIN the 200 pages of the recently published third edition of "Principles of Fruit Preservation," written by T. N. Morris, M.A., is compressed a wealth of information remarkable for a book of this size. Combining theoretical considerations with practical detail it provides a valuable reference on most aspects of fruit processing both for the technical expert and for the student of the subject. It has not been possible in the limited space to consider all sections of the subject in great detail, but the concise method of presentation together with the extensive use of headings and sub-headings has enabled the writer to be brief and to the point.

The subject matter is considered in four main sections. Part one contains a discussion of pectins and the pectin-sugar-acid complex leading up to the manufacture of jams. A briefer treatment of refrigeration, frozen fruit products, crystallised fruits and fruit juices is also included.

Canning is dealt with in Part 2, which apart from the processing angle, treats the subject of spoilage which includes the latest information on tin plate corrosion. The laboratory examination of processed products is dealt with at considerable length in the latter part of this section.

Another important phase of fruit preservation, namely drying, forms the subject matter of Part 3. Methods of moisture determination, drying processes, and means of combating insect damage during storage are dealt with, together with the modern trends in dehydration. A valuable inclusion in this latter discussion is a set of tables giving detailed dehydration data for various fruits.

An interesting aspect of fruit preservation, namely, fruit colours and discolouration is included in the final section which also makes brief reference to vitamins.

It would be difficult to find a book of this nature which covers more completely the subject treated. The summary of latest information contained in the publication is further enhanced by the extensive list of references given at the end of each chapter. It could well form a valuable addition to a technical library as well as being useful to a factory processing management.—F.M.

("Principles of Fruit Preservation" by T. N. Morris, M.A. Third Edition Revised. Price, 2s. sterling. Published by Chapman and Hall, London.)

A BOOK ON HAYMAKING

A GOOD farmer is a good customer, and improved agricultural methods confer benefits not only upon the farmers who practise them, but on the business firms with whom they deal, and on a wide section of the food-consuming public who are also potential customers.

That these facts are realised by a number of business houses directly or indirectly associated with agriculture, is indicated by the many valuable contributions to the world-wide campaign for better farming methods which have been made, and are still being made, by commercial and industrial firms.

Many such firms maintain staffs of agricultural advisers and field officers whose task it is to endeavour to raise the standards of agriculture among the firm's clients. Some firms have made worth-while contributions in the field of farming literature, and recently to hand is a copy of "Hay is How You Make It," published by the International Harvester Company of Australia Pty., Limited—an attractively printed 76-page, volume which is filled with sound advice on haymaking, stockfeeding and fodder conservation in general.

"Hay is How You Make It" is a companion volume to "Lets Improve Our Pastures" and "Are We Soil Managers?" two previous I.H.C. publications, which were cordially received by the farming industry.

The booklet covers every aspect of the subject of haymaking—standard practices and improved methods, ranging from soil management to the consumption and conservation of nutritious fodders. The authors have attempted to describe in lay language, plant life from seed germination in fertile soil; the growth of healthy grass, legume and cereal plants; the processing of fodders by grinding, using feed grinders and hammer mills for both roughages and concentrates; haymaking practices in Australia; improved methods, using modern equipment for haymaking; labour efficiency involved in the use of haying machinery; the feeding of various classes of livestock; and have climaxed the story with the subject "Prepare NOW for the Next Drought." The booklet is of more than seasonal interest to farmers. Its contents deal with all-the-year-round feeding management with the greatest emphasis on fodder conservation.

The book is well illustrated and full advantage has been taken of a mass of information made available by the States' Departments of Agriculture and a number of standard publications.

Farmers desirous of obtaining a copy should get in touch with their nearest I.H.C. representative.

DWELLING DESIGN

IN a recent addition to the series of Notes on the Science of Building—Number S.B. 21—the Commonwealth Experimental Building Station has provided a useful and interesting summary of information on the design of dwellings for summer and winter conditions in Australia's temperate zones, as well as some pertinent comments on the provision of more effective space heating than the "cheerful" but draughty open fire.

S.B. 21 may be obtained free on application to the Building Research Liaison Service, P.O. Box 2807 AA, Melbourne.

A REMINDER

HAVE you registered your orchard? One fruit tree or a single vine is an orchard for the purposes of the Plant Diseases Act and must be registered accordingly. The registration fee for less than one acre of trees or vines is 1s. Apply Department of Agriculture, Perth.

SUNRISE AND SUNSET TIMES FOR MAY-JUNE, 1952

(Supplied by the Government Astronomer)

Times of sunrise and sunset for every fifth day, are given for a number of towns throughout the State. Times for a town not on the list may be estimated if its position in relation to one or more of the listed towns is known. The times given for sunrise are those of the first appearance of the top edge of the sun over a true horizon; those for sunset give the time of the sun's disappearance below a true horizon. Situation in a valley would make the sun appear to rise later, and on a hill it would appear earlier.

SUNRISE

Month.	Day of Month.	Broome.	Port Hedland.	Onslow.	Carnarvon.	Yalgoo.	Geraldton.	Moora.	Kalgoorlie.	Southern Cross.	Merredin.	Perth.	Tammin.	Northam.	Narrogin.	Collie.	Bunbury.	Katanning.	Bridgetown.	Hopetoun.	Esperance.	Cape Leeuwin.	Albany.
May	1	6·4	6·21	6·38	6·46	6·38	6·49	6·46	6·24	6·33	6·37	6·48	6·41	6·44	6·45	6·49	6·51	6·44	6·49	6·34	6·27	6·54	6·44
,, ...	5	6·6	6·23	6·40	6·49	6·41	6·52	6·49	6·27	6·36	6·40	6·51	6·44	6·47	6·48	6·52	6·54	6·47	6·52	6·37	6·30	6·57	6·47
,, ...	10	6·7	6·25	6·42	6·51	6·44	6·55	6·52	6·30	6·39	6·43	6·55	6·48	6·51	6·51	6·55	6·57	6·51	6·56	6·41	6·34	7·1	6·51
,, ...	15	6·8	6·26	6·43	6·53	6·47	6·57	6·55	6·33	6·42	6·46	6·58	6·51	6·54	6·54	6·58	7·0	6·54	6·59	6·44	6·37	7·4	6·54
,, ...	20	6·10	6·28	6·46	6·56	6·49	7·0	6·58	6·36	6·45	6·49	7·1	6·54	6·57	6·58	7·2	7·4	6·58	7·3	6·48	6·41	7·8	6·58
,, ...	25	6·12	6·30	6·48	6·58	6·52	7·3	7·1	6·39	6·48	6·52	7·4	6·57	7·0	7·2	7·6	7·8	7·2	7·7	6·52	6·45	7·12	7·2
,, ...	31	6·15	6·33	6·51	7·2	6·56	7·7	7·5	6·43	6·52	6·56	7·8	7·1	7·4	7·6	7·10	7·12	7·6	7·11	6·56	6·49	7·16	7·6
June....	1	6·16	6·34	6·52	7·3	6·57	7·8	7·6	6·44	6·53	6·57	7·9	7·2	7·5	7·7	7·11	7·13	7·7	7·12	6·57	6·50	7·17	7·7
,, ...	5	6·16	6·35	6·53	7·4	6·58	7·9	7·7	6·45	6·54	6·58	7·11	7·4	7·7	7·8	7·12	7·14	7·9	7·14	6·59	6·52	7·19	7·9
,, ...	10	6·18	6·37	6·55	7·6	7·1	7·12	7·10	6·48	6·57	7·1	7·14	7·7	7·10	7·11	7·15	7·17	7·12	7·17	7·2	6·55	7·22	7·12
,, ...	15	6·19	6·39	6·57	7·8	7·3	7·14	7·12	6·50	6·59	7·3	7·16	7·9	7·12	7·13	7·17	7·19	7·14	7·19	7·4	6·57	7·24	7·14
,, ...	20	6·19	6·39	6·57	6·9	7·4	7·15	7·13	6·51	7·0	7·4	7·17	7·10	7·13	7·14	7·18	7·20	7·15	7·20	7·5	6·58	7·25	7·15
,, ...	25	6·21	6·40	6·58	7·10	7·5	7·16	7·14	6·52	7·1	7·5	7·18	7·11	7·14	7·15	7·19	7·21	7·16	7·21	7·6	6·59	7·26	7·16
,, ...	30	6·22	6·41	6·59	7·11	7·6	7·17	7·15	6·53	7·2	7·6	7·19	7·12	7·15	7·16	7·20	7·22	7·17	7·22	7·7	7·0	7·27	7·17
SUNSET																							
May	1	5·31	5·44	5·55	5·56	5·41	5·48	5·39	5·17	5·26	5·30	5·39	5·32	5·35	5·32	5·36	5·38	5·29	5·34	5·19	5·12	5·39	5·25
,, ...	5	5·29	5·42	5·53	5·54	5·38	5·45	5·36	5·14	5·23	5·27	5·36	5·29	5·32	5·29	5·33	5·35	5·26	5·31	5·16	5·9	5·36	5·22
,, ...	10	5·27	5·39	5·50	5·50	5·34	5·41	5·32	5·10	5·19	5·23	5·31	5·24	5·27	5·25	5·29	5·31	5·21	5·26	5·11	5·4	5·31	5·17
,, ...	15	5·25	5·37	5·48	5·48	5·31	5·39	5·29	5·7	5·16	5·20	5·28	5·21	5·24	5·21	5·25	5·27	5·17	5·22	5·7	5·0	5·27	5·13
,, ...	20	5·23	5·35	5·46	5·45	4·28	5·36	5·26	5·4	5·13	5·17	5·25	5·18	5·21	5·18	5·22	5·24	5·14	5·19	5·4	4·57	5·24	5·10
,, ...	25	5·22	5·34	5·44	5·43	5·26	5·33	5·23	5·1	5·10	5·14	5·22	5·15	5·18	5·15	5·19	5·21	5·11	5·16	5·1	4·54	5·21	5·7
,, ...	31	5·22	5·34	5·44	5·43	5·25	5·32	5·22	5·0	5·9	5·13	5·20	5·13	5·16	5·13	5·17	5·19	5·8	5·13	4·58	4·51	5·18	5·4
June....	1	5·22	5·34	5·44	5·43	5·25	5·32	5·22	5·0	5·9	5·13	5·20	5·13	5·16	5·13	5·17	6·19	5·8	5·13	4·58	4·51	5·18	5·4
,, ...	5	5·22	5·33	5·43	5·42	5·24	5·31	5·21	4·59	5·8	5·12	5·19	5·12	5·15	5·12	5·16	5·18	5·7	5·12	4·57	4·50	5·17	5·3
,, ...	10	5·23	5·34	5·44	5·42	5·24	5·31	5·21	4·59	5·8	5·12	5·19	5·12	5·15	5·12	5·16	5·18	5·7	5·12	4·57	4·50	5·17	5·3
,, ...	15	5·24	5·35	5·45	5·43	5·24	5·31	5·21	4·59	5·8	5·12	5·19	5·12	5·15	5·12	5·16	5·18	5·7	5·12	4·57	4·50	5·17	5·3
,, ...	20	5·24	5·35	5·45	5·44	5·25	5·32	5·21	4·59	5·8	5·12	5·20	5·13	5·16	5·12	5·16	5·18	5·8	5·13	4·58	4·51	5·18	5·3
,, ...	25	5·25	5·36	5·46	5·45	5·26	5·33	5·22	5·0	5·9	5·13	5·21	5·14	5·17	5·13	5·17	5·19	5·9	5·14	4·59	4·52	5·19	5·4
,, ...	30	5·27	5·38	5·48	5·46	5·28	5·35	5·25	5·3	5·12	5·16	5·23	5·16	5·19	5·16	5·20	5·23	5·11	5·16	5·1	4·54	5·21	5·7